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FOREST PEST MANAGEMENT

Bark Beetle Conditions

Northern Region

1988

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USDA Forest Service
Northern Region

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BARK BEETLE CONDITIONS NORTHERN REGION 1988

by

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BARK BEETLE CONDITIONS
NORTHERN REGION
1988

INTRODUCTION

Bark beetles of several species continued to have significant effects on host stands throughout the Region in 1988. While mountain pine beetle outbreaks, extant now for more than two decades, continued to decline Regionwide, they are still influencing management decisions on several Forests. The continuing drought has resulted in unusual amounts of mortality caused by Douglas-fir beetles, western pine beetles, pine engravers, and fir engravers. Similar sets of conditions, and the need to report on the status of various bark beetle pests for 1987, culminated in a departure from past reporting practices (Gibson and Oakes 1988). This report will update the 1987 report.

As we have done previously, we caution the reader from implying more from data contained in this report than what is presented. Most area infestation figures are derived from aerial survey estimates. Though aerial surveys are invaluable as a means of detecting and tracking infestations over space and time, they are not entirely free from errors of estimation. The extent of an infestation, as judged by an aerial observer, is quite accurate. It would be erroneous, however, to conclude that every tree, or every host tree, within that infested area has been affected by the pest being reported. In addition, estimating mortality from the air is often difficult--made more so by the dry weather we have experienced for the past few years. For that reason, aerial mortality estimates should be used as relative indicators of infestation trend and not as absolute parameters delimiting pest-caused damage.

For the above reasons, we strive to collect ground data from infested areas as a means of making more accurate--and therefore, more valuable to the resource manager--mortality or damage estimates. In that way we are not only better able to gauge infestation intensity from site to site, but are much more accurate in predicting infestation trends. Still, the number of sites we are capable of visiting each year is limited. Data collected in a particular stand very accurately represent what has taken place, or is taking place, at that site. It less accurately represents what has taken place, or may be taking place, on adjacent stands or on other parts of a Ranger District, for example. We present data in the following tables as representing conditions from whence the data were collected. Similar stands may or may not be similarly affected. It is safer to assume that as an infestation "runs its course," stands of like conditions may bear like damages. Should this report serve as the impetus to alter susceptible stand conditions and thereby forestall pest-related mortality in as-yet uninfested stands, the effort expended in collecting and reporting these data will have been time well spent.

MOUNTAIN PINE BEETLE

Mountain pine beetle (MPB) outbreaks have been reported with some regularity in the Northern Region in one or more of the beetles' several hosts, since the early decades of the 20th century. The current series of infestations, however, have continued since the mid-1960's when unusually large amounts of lodgepole pine were reported killed in Yellowstone National Park (NP). Within the next several years, major infestations were found on the Gallatin and Beaverhead National Forests (NF). In the early 1970's, outbreaks began in Glacier NP and within a few years infestations began on the Kootenai and Lolo NF's, Blackfoot and Flathead Indian Reservations (IR) and adjacent State and private lands. In northern Idaho, outbreaks have been recorded on portions of the Idaho Panhandle and Nezperce NF's. Virtually no forested lands in the Northern Region, which contain appreciable acreages of host type, have completely escaped depredations by MPB in the past 25 years.

Since 1981, when nearly 2.5 million acres were affected Regionwide, areas infested by MPB have gradually declined. In 1987, approximately 722,000 acres had been infested. In 1988, the area still in outbreak status, in all hosts and on all ownerships, totaled slightly less than 560,000 acres (Tables 1 and 2). Some infestations, notably isolated ones on the Lolo, Flathead, and Kootenai NF's, are still increasing. Most, however, in response to management activities and host depletion, are continuing to decline. Several Forests in northern Idaho and western Montana have expansive areas of lodgepole pine generated following the widespread fires of 1910. Barring efforts by resource managers to reduce susceptibility to MPB in those stands, many may harbor outbreaks within the next 20 years. Until that time, we anticipate continually declining MPB populations.

Table 1.--Acres under Federal jurisdiction in the Northern Region on which mountain pine beetle-caused mortality was aerially observed, 1987 and 1988.

	-----1987-----				-----1988-----			
Area	LPP[1]	PP	WBP	WWP	LPP	PP	WBP	WWP
Beaverhead NF	18	--	1	--	6	--	--	--
Bitterroot NF	2,882	2,713	--	--	1,588	2,402	1	--
Clearwater NF	3	--	--	2	--	--	--	1
Custer NF	--	4	--	--	--	2	--	--
Deerlodge NF	1,697	1	--	--	1,478	5	--	--
Flathead NF	181,149	757	551	767	92,778	39	98	104
Gallatin NF	455	--	--	--	*	*	*	*
Helena NF	305	403	18	--	1	8	--	--
Idaho Panhandle NF's	455	90	--	44	757	9	6	9
Kootenai NF	272,205	7,354	859	1,772	304,785	6,306	21	458
Lewis & Clark NF	15	1,124	1	--	1	179	--	--
Lolo NF	23,973	736	43	3	28,051	813	3	84
Nezperce NF	6,480	3	303	1	2,341	271	--	--
Total NF	489,637	13,185	1,776	2,589	431,785	10,034	129	656
Glacier NP	1,183	--	--	31	*	*	*	*
Yellowstone NP	--	--	--	--	*	*	*	*
Blackfoot IR	41	--	2	--	*	*	*	*
Crow IR	--	3,928	--	--	--	3,635	--	--
Flathead IR	2,239	1,917	2	--	1,429	47	5	2
Ft. Belknap IR	--	--	--	--	*	*	*	*
N. Cheyenne IR	--	693	--	--	--	19	--	--
Rocky Boy's IR	24	17	--	--	*	*	*	*
BLM (Total)	3,668	750	--	--	1,037	293	1	--
Total (Non-NF)	7,155	7,305	2	31	2,466	3,994	6	2
Total Federal	496,792	20,490	1,778	2,620	434,251	14,028	135	658

[1]LPP = Lodgepole pine; PP = Ponderosa pine WBP = whitebark pine; WWP = western white pine.
* Not flown in 1988.

Table 2.--Acres of State and private ownership in the Northern Region on which mountain pine beetle-caused mortality was aerially observed, 1987 and 1988.

	-----1987-----				-----1988-----			
Area	LPP[1]	PP	WBP	WWP	LPP	PP	WBP	WWP
Beaverhead NF	6	--	--	--	3	--	--	--
Bitterroot NF	1	2,361	--	--	--	4,243	--	--
Clearwater NF	--	--	--	--	--	--	--	--
Custer NF	--	--	--	--	--	--	--	--
Deerlodge NF	300	--	--	--	147	4	--	--
Flathead NF	51,071	12,167	--	71	13,643	2,088	--	4
Gallatin NF	311	--	--	--	*	*	*	*
Helena NF	116	167	1	--	1	18	--	--
Idaho Panhandle NF's	1	8	--	4	--	--	2	--
Kootenai NF	36,040	3,180	127	--	34,276	1,705	--	7
Lewis & Clark NF	106	191	--	--	--	425	--	--
Lolo NF	22,063	1,169	1	--	10,092	331	2	1
Nezperce NF	963	--	--	--	226	1	--	--
Stillwater SF	58,717	630	420	--	28,337	1	1	21
Swan River SF	4	1	--	--	235	--	--	10
Thompson River SF	4,570	207	--	--	5,921	391	--	--
Garnets	53	1,392	--	--	7	641	--	--
Cataldo FPD	--	--	--	--	246	68	--	--
CLW/Potlatch FPD	--	--	--	4	--	1	--	--
Kendrick FPD	--	--	--	--	--	--	--	--
Mica FPD	--	--	--	--	179	2	--	--
W St. Joe FPD	--	--	--	1	--	--	--	--
Craig Mountains	3,018	185	--	--	6,025	36	--	--
Maggie Creek FPD	--	--	--	--	--	1	--	--
Total	177,340	21,658	549	359	99,338	9,956	5	43

* Not flown in 1988.

Following are aerial survey estimates and/or ground-collected data, by reporting area, for forested lands still experiencing MPB infestations.

Beaverhead National Forest

In 1981, when MPB-infested acres peaked in the Region, the Beaverhead NF had more than 120,000 acres showing some level of beetle-caused mortality. Having declined each year since, few infested acres were observed on the Forest in 1988. Only 9 acres were noted--those on Federal and private land northwest of Wise River (Table 1). Though susceptible lodgepole pine stands are found on the Wisdom and Wise River Ranger Districts (RD), no known epidemics exist anywhere on the Forest.

Bitterroot National Forest

Total infested acres increased slightly on the Bitterroot NF in 1988. A decrease in lodgepole pine mortality near Dennis Mountain on the West Fork RD was offset by a significant increase in acres of ponderosa pine affected on State land in French Basin (Appendix, Figure 1). Increases in acres of infested ponderosa pine on the Stevensville and Sula RD's are likely correlated with past dry weather. Depending on how quickly trees respond, a return to improved moisture conditions should slow the beetles' advance.

Ground collected data showed a general decline in attacked trees (for those areas sampled) in 1988 (Table 3).

Table 3.--Acres infested and trees per acre killed by mountain pine beetle, Bitterroot reporting area, 1987 and 1988.

	- - - Acres infested [1] - - -			- - - Average no. trees/acre killed [2] - - -			
Ownership	Host	1987	1988	Older	1987	1988	To date
Darby RD	LPP PP	0 2,191	0 1,612	-- 10.1	-- 30.6	-- 39.6	-- 80.3
Stevensville RD	LPP PP	0 0	0 150	-- --	--	--	--
Sula RD	LPP PP	0 377	0 512	-- 31.9	-- 102.1	-- 60.6	-- 194.6
West Fork RD	LPP PP	2,882 145	1,588 3	-- 55.5	-- 29.8	-- 16.3	101.6
State, private other	LPP PP	1 2,361	0 4,243	-- --	-- --	-- --	-- --
Total/weighted average		7,957	8,105	30.3	51.8	38.9	121.0

[1]Aerial survey estimates
[2]Ground survey data (averaged from number of stands visited)

Custer National Forest

One 2-tree group of ponderosa pine killed by MPB was noted east of Ashland in 1988. Though susceptible ponderosa pine stands exist on the Ashland and Sioux RD's and lodgepole pine stands of moderate hazard are found on the Beartooth RD, no other beetle-caused mortality was observed (Tables 1 and 2). The devastating fires which occurred on the Ashland and Sioux RD's in 1988 could result in increases of some bark beetle or wood borer populations in 1989.

Deerlodge National Forest

Forestwide, total infested acres declined in 1988. Less than 1,700 acres are currently infested--compared to 2,000 in 1987 (Appendix, Figure 2, Table 4). Most affected areas are lodgepole pine stands in the vicinity of Homestake Pass. One set of five ground plots near Little Blacktail Creek on the Butte RD showed a significant increase in attacked trees in 1988. We believe that is not indicative of the infestation elsewhere on the District. On the Jefferson RD, 50 plots in 8 separate areas showed an essentially static population at an average 26 trees per acre attacked in 1988 (Table 4). Management activities in those areas are reducing the likelihood of increasing outbreaks.

Table 4.--Acres of lodgepole pine infested and trees per acre killed by mountain pine beetle, Deerlodge reporting area, 1987 and 1988.

	Acres infested		- - - Avg. no. trees/acre killed - - -			
Ownership	1987	1988	Older	1987	1988	To date
Butte RD	100	25	0	3.6	37.6	41.2
Deerlodge RD	0	7	--	--	--	--
Jefferson RD	1,596	1,442	23.0	27.3	26.6	76.9
Philipsburg Rd	1	4	--	--	--	--
State, private, other	303	147	--	--	--	--
Total weighted average	2,000	1,625	20.8	24.7	27.8	73.3

Flathead National Forest

Infested acres on the Flathead NF in 1988 decreased to less than half those recorded in 1987--down to fewer than 110,000 acres from more than 250,000 (Table 5 and Appendix, Figure 3). Major decreases occurred on all Districts except Hungry Horse where a very slight increase in acres infested was noted. Though some ground-collected data showed small increases, there was a general decrease Forestwide in those areas surveyed (Table 5). Stand hazard reduction through regeneration or sanitation thinning and host depletion from beetle activity should result in further decreases in beetle-caused losses in 1989.

Table 5.--Acres of host infested and lodgepole pine per acre killed by mountain pine beetle, Flathead reporting area, 1987 and 1988.

	- - - Acres infested - - -			- - Average no. trees/acre killed - -			
Ownership	Host	1987	1988	Older	1987	1988	To date
Glacier View RD	LPP	21,226	12,964	38.4	40.3	14.3	93.0
	WBP	543	59	33.8	11.4	0.1	45.3
	WWP	75	6	--	--	--	--
Hungry Horse RD	LPP	13,683	15,298	11.7	28.5	29.2	69.4
	PP	0	1	--	--	--	--
	WBP	3	27	--	--	--	--
	WWP	293	55	--	--	--	--
Spotted Bear RD	LPP	63	68	0	0	15.5	15.5
	WBP	5	11	--	--	--	--
	WWP	7	4	--	--	--	--
Swan Lake RD	LPP	27,810	2,818	6.2	15.0	20.0	41.2
	PP	757	2	--	--	--	--
	WBP	0	1	--	--	--	--
	WWP	392	29	--	--	--	--
Tally Lake RD	LPP	118,367	61,630	107.9	3.9	0.7	112.5
	PP	0	36	--	--	--	--
	WWP	0	10	--	--	--	--
State, private, other	LPP	54,151	14,673	--	--	--	--
	PP	12,630	2,124	--	--	--	--
	WWP	71	5	--	--	--	--
Total/weighted average (LPP)		250,076	109,821	18.6	27.1	25.0	70.7

Gallatin National Forest

Though more than 700 acres of scattered MPB-caused mortality was recorded on the Gallatin NF in 1987, and it is likely some of those areas north of Livingston and near Gardiner remain, the Forest was not flown in 1988 (Tables 1 and 2). Scheduled for an annual flight, forested areas in and around Yellowstone NP were not flown because of the expansive fires which occurred in late summer, 1988.

Like much of the Northern Region, MPB activity peaked on the Gallatin NF in 1981 at nearly 456,000 acres infested. Though some susceptible lodgepole pine stands remain on some Districts, the massive infestations of a decade ago will not soon be repeated on the Hebgen Lake and Bozeman RD's because of a scarcity of stands capable of initiating and maintaining MPB outbreaks.

Helena National Forest

Mountain pine beetle populations on the Helena NF have returned to nearly endemic conditions. Forest-wide, only 2 acres of lodgepole pine and 28 acres of ponderosa pine faders were recorded in 1988. There has been a dramatic decrease in infested acres in just the past 2 years: more than 4,800 acres contained beetle-killed trees in 1986, just over 1,000 acres in 1987, and 30 acres in 1988 (Table 6). Though stands of lodgepole pine capable of supporting MPB can be found on the Townsend RD and susceptible ponderosa pine stands exist on the Helena and Lincoln RD's, beetle populations are presently low enough that serious outbreaks likely will not occur in the next few years.

Table 6.--Acres infested by mountain pine beetle, Helena reporting area, 1987 and 1988.

	----- 1987 -----			----- 1988 -----		
Ownership	LPP	PP	WBP	LPP	PP	WBP
Helena RD	236	401	0	1	4	0
Lincoln RD	3	2	1	0	3	0
Townsend RD	66	0	17	0	1	0
State, private, other	116	169	1	1	20	0
Total	421	572	19	2	28	0

Idaho Panhandle National Forests

Though MPB infestations are not extreme on the Forest, the IPNF's did experience increases in infested acres in several locations in 1988 (Appendix, Figure 4, Table 7). The outbreak located in Boulder Creek drainage, Bonners Ferry RD increased by 100 acres. While acres containing faded lodgepole pine increased, ground data showed fewer attacked trees in 1988 (Table 8). Other infestations of 113 acres, on the Wallace RD northwest of Lookout Pass and 100 acres near Frost Peak on the Fernan RD were noted. Elsewhere on the Forest, MPB-killed trees were generally light and scattered.

Table 7.--Acres infested by mountain pine beetle, Idaho Panhandle reporting area, 1987 and 1988.

	----- 1987 -----				----- 1988 -----			
Ownership	WWP	LPP	PP	WBP	WWP	LPP	PP	WBP
Bonners Ferry RD	0	413	8	2	1	501	1	0
Fernan RD	1	0	2	14	0	100	1	0
Priest Lake RD	1	0	78	6	3	3	0	0
Sandpoint RD	0	0	0	0	0	40	7	2
St. Maries RD	0	41	0	0	3	0	0	2
Wallace RD	0	1	2	12	0	113	0	1
Avery RD	0	0	0	0	2	0	0	0
State, private, other	0	1	9	4	1	0	0	2
Total	2	456	99	48	10	757	9	7

Table 8.--Lodgepole pine per acre killed by mountain pine beetle, selected plots (31) on Bonners Ferry RD, 1988.

Average number trees/acre killed			
Older	1987	1988	To date
22.0	11.9	7.0	40.9

Kootenai National Forest

Areas on the Kootenai NF contain some of the most active beetle infestations in the Region. While Fisher River RD showed a significant decline in affected areas, Libby RD exhibited an essentially static trend. Fortine and Rexford RD's on the other hand showed marked increases in beetle-caused losses (Appendix, Figure 5, Table 9). With the exception of the Rexford RD, where only a slight decrease in currently infested trees were observed, ground data indicate decidedly downward trends in other areas sampled Forestwide (Table 9). Data suggest that with the exception of small, local infestations in some areas, such as Dodge and Sullivan Creek drainages on the Rexford RD, where populations appear to be building, the outbreak on the Kootenai NF has begun to decline.

Table 9.--Acres infested and trees per acre killed by mountain pine beetle, Kootenai reporting area, 1987 and 1988.

	- - - Acres infested - - -			- - - Average no. trees/acre killed - - -			
Ownership	Host	1987	1988	Older	1987	1988	To date
Cabinet RD	LPP	1,971	2,083	--	--	--	--
	PP	5	5	--	--	--	--
	WBP	5	1	--	--	--	--
	WWP	151	24	--	--	--	--
Fisher River RD	LPP	86,587	46,667	131.3	9.6	1.9	142.8
	PP	2,509	3,723	--	--	--	--
	WWP	29	3	--	--	--	--
Fortine RD	LPP	51,030	68,376	37.8	68.4	14.6	120.8
	PP	156	136	--	--	--	--
	WBP	828	1	--	--	--	--
Libby RD	LPP	56,523	57,203	81.0	64.9	23.7	169.6
	PP	4,682	2,023	1.5	12.3	6.9	20.7
	WBP	26	20	--	--	--	--
	WWP	465	82	--	--	--	--
Rexford RD	LPP	63,875	111,760	19.4	29.5	28.9	77.8
	PP	1	415	--	--	--	--
	WWP	326	41	--	--	--	--
Three Rivers RD (Troy)	LPP	1,586	6,705	--	--	--	--
	PP	1	4	--	--	--	--
	WWP	286	10	--	--	--	--
Three Rivers RD (Yaak)	LPP	10,633	11,991	24.7	40.8	0	65.6
	WWP	515	297	--	--	--	--
State, private, other	LPP	36,040	34,276	--	--	--	--
	PP	3,180	1,705	--	--	--	--
	WWP	127	7	--	--	--	--
Total/weighted average	LPP	308,245	339,061	56.7	48.4	19.4	124.5
	PP	10,534	8,011	--	--	--	--
Species total/weighted average		321,537	347,558				

Lewis & Clark National Forest

Acres shown to contain ponderosa pine killed by MPB declined by nearly half in 1988. Whereas, more than 1,500 acres were observed throughout the reporting area in 1987, that figure had declined to 791 last year. Almost no lodgepole pine faders were observed (Appendix, Figure 6, Table 10). Ground plots placed throughout the Judith RD showed a significant decrease in attacked trees--almost 42 in 1987, 3 in 1988 (Table 11). In fact, at only one site, Yogo Creek, were any currently infested trees noted at all. Those data indicate a continuing declining trend in beetle populations in the reporting area.

Table 10.--Acres infested by mountain pine beetle, Lewis & Clark reporting area, 1987 and 1988.

	- - - 1987 - - -		- - - 1988 - - -	
Ownership	LPP	PP	LPP	PP
Judith RD	0	512	0	107
Kings Hill RD	0	333	0	1
Mussellshell RD	15	279	1	71
BLM	2	233	0	187
State & private	106	191	0	425
Total	123	1,548	1	791

Table 11.--Ponderosa pine per acre killed by mountain pine beetle, selected plots (28) on Judith RD, 1988.

Average number trees/acre killed			
Older	1987	1988	To date
20.4	41.9	3.0	65.4

Lolo National Forest

Throughout the Lolo NF reporting area, there was nearly a 20 percent decrease in infested acres from 1987 to 1988--from just under 50,000 acres to slightly more than 40,000 acres (Table 12). Increases were noted on Ninemile, Superior, and Thompson Falls RD's, while essentially static populations were recorded on Missoula and Plains RD's. Infested acres on State and private lands declined by half (Appendix, Figures 7 and 8). Mortality data collected on ground plots showed a slight decrease in lodgepole pine stands in the upper Ninemile Creek drainage, but notable increases in a ponderosa pine plantation near Little Blue Creek. Active, though nearly static, infestations continue in the Hinchwood Creek/McGinnis Creek areas on the Plains RD. Small infestations were observed in susceptible stands near Glidden Gulch on the western portion of the Thompson Falls RD. Ponderosa pine stands in the Garnet Mountains were less severely affected in 1988.

Table 12.--Acres infested and trees per acre killed by mountain pine beetle, Lolo reporting area, 1987 and 1988.

	- - - Acres infested - - -			- - - Average no. trees/acre killed - - -			
Ownership	Host	1987	1988	Older	1987	1988	To date
Missoula RD	LPP	0	0	--	--	--	--
	PP	6	24	--	--	--	--
	WBP	0	0	--	--	--	--
Ninemile RD	LPP	487	1,924	17.7	23.1	22.8	63.6
	PP	266	315	10.3	11.2	40.9	62.4
	WWP	0	0	--	--	--	--
Plains RD	LPP	20,197	20,733	35.3	31.0	28.1	94.4
	PP	11	54	--	--	--	--
	WBP	0	0	--	--	--	--
	WWP	0	0	--	--	--	--
Seely Lake RD	LPP	19	2	--	--	--	--
	PP	83	1	--	--	--	--
	WBP	0	0	--	--	--	--
Superior RD	LPP	316	1,422	--	--	--	--
	PP	369	355	--	--	--	--
	WBP	1	0	--	--	--	--
	WWP	1	81	--	--	--	--
Thompson Falls RD	LPP	2,954	3,970	4.9	2.4	2.8	10.1
	PP	1	84	--	--	--	--
	WBP	42	3	--	--	--	--
	WWP	2	3	--	--	--	--
Garnet Mtns.	LPP	54	641	--	--	--	--
	PP	1,442	7	--	--	--	--
State, private, other	LPP	22,568	10,092	--	--	--	--
	PP	1,169	332	--	--	--	--
	WBP	1	2	--	--	--	--
	WWP	1	1	--	--	--	--
Total/weighted average	LPP	46,595	38,784	18.4	17.8	17.0	53.2
	PP	3,347	1,152	10.3	11.2	40.9	62.4
Species total		49,989	40,026	--	--	--	--

Nezperce National Forest

Infestations in lodgepole pine stands near Red River and Elk City continued to decline in 1988 (Appendix, Figure 9). Infested acres Forestwide declined by nearly two thirds--from more than 7,700 to less than 2,900 (Table 13). Mortality data collected from ground plots on Red River RD in 1988 also showed a decline--though not a large one. Through the use of pheromone baits and aggressive management, many accessible lodgepole pine stands are being brought under management on the Forest. Those activities, as well as the length of the infestation itself, should result in a continual decline in MPB-caused impacts.

Table 13.--Acres infested and trees per acre killed by mountain pine beetle, Nezperce reporting area, 1987 and 1988.

	- - - Acres infested - - -			- - - Average no. trees/acre killed - - -			
Ownership	Host	1987	1988	Older	1987	1988	To date
Clearwater RD	LPP PP	0 1	1 103	-- --	-- --	-- --	-- --
Elk City RD	LPP	55	87	--	--	--	--
Red River RD	LPP PP WBP	6,425 0 0	2,252 0 0	27.8 -- --	18.1 -- --	17.5 -- --	63.4 -- --
Salmon River RD	LPP PP WBP	0 1 303	1 168 0	-- -- --	-- -- --	-- -- --	-- -- --
Selway RD	PP WWP	1 1	0 0	-- --	-- --	-- --	-- --
State, private, other	LPP PP	994 0	226 57	-- --	-- --	-- --	-- --
Total/weighted average	LPP	7,474	2,567	27.8	18.1	17.5	63.4
Species total		7,781	2,895	--	--	--	--

Glacier and Yellowstone National Parks

The two National Parks in the Northern Region have harbored some of the most devastating MPB outbreaks ever recorded. First reported in the early 1960's, the Yellowstone NP infestations increased through the 1960's and 1970's, peaking in 1981 at more than 960,000 acres of lodgepole and whitebark pines infested. The tremendous wildfires which swept through the Park in 1988 were the natural aftermath of such widespread beetle-caused mortality. Though the Park was not flown in 1988 because of the firefighting effort and smoke, few beetles are to be found today. A small population has killed limber pines near Mammoth. A small infestation is extant near Mammoth Terrace but appears to be in decline. Ground plots there showed 25 trees per acre killed in 1987 but only 3 per acre in 1988.

In Glacier NP, a small beetle infestation in lodgepole and western white pines was likewise observed on a few hundred acres in the early 1960's. That infestation was short-lived, but served as a portent of things to come. Not reported again until 1971, an outbreak began on the west side of the Park near Quartz Creek. Sweeping through extensive lodgepole pine stands on the west side throughout the 1970's, stands on the east side were infested by the end of the decade. In 1980, nearly 277,000 acres of lodgepole pine and another 16,000 acres of ponderosa, western white and whitebark pines showed massive amounts of dead trees. Surveys showed some stands exceeded 400 trees per acre killed. Since 1981, infested acres have been decreasing. The Park was not flown in 1988, but just over 1,200 acres were still infested in 1987 near the southern border. We believe that infestation continued its decline in 1988.

Montana Indian Reservations

As with most areas in the Region, MPB infestations on all IR's surveyed declined in 1988. Though not all were flown, and fewer still were surveyed on the ground, decreasing numbers were recorded in all areas (Tables 14 and 15). On the Crow IR, aerial survey estimates showed only slightly fewer acres of ponderosa pine infested than recorded in 1987. Ground surveys there, however, showed not only a decidedly declining trend, but that many trees were actually killed by secondary beetles. In the areas sampled, no new attacks were found (Table 14). Infested stands are generally confined to the upper portion of Corral Creek drainage (Appendix, Figure 10).

On the Northern Cheyenne IR, the infestation previously building in ponderosa pine stands in the Dry Creek and South Fork Busby Creek drainages has been reduced to fewer than 20 acres (Appendix, Figure 10). Many of the infested stands, including six stands partial cut as a demonstration of the effectiveness of sanitation thinning in east-side ponderosa pine, have been harvested.

Much of the infested area on the Flathead IR has decreased to small scattered groups--mostly along the western edge of the Reservation, in the northeast corner east of Flathead Lake, and in the Jocko River drainage in the southeast portion (Appendix, Figure 11). Infested lodgepole pine stands have decreased from 2,239 acres in 1987 to 1,429 in 1988. Fewer than 50 acres of ponderosa pine faders, down from more than 1,900 in 1987, were recorded in 1988 (Table 15).

Table 14.--Acres infested and trees per acre killed by mountain pine beetle, Indian Reservations in eastern Montana, 1987 and 1988.

	- - - Acres infested - - -			- - - Average no. trees/acre killed - - -			
Reservation	Host	1987	1988	Older	1987	1988	To date
Blackfeet	LPP	41	*	--	--	--	--
Crow	PP	3,928	3,635	11.9	53.7	0	65.6
Ft. Belknap	PP	0	*	--	--	--	--
N. Cheyenne	PP	693	19	1.3	13.0	0.4	14.7
Rocky Boy's	LPP PP	41	*	--	--	--	--

* Not flown in 1988.

Table 15.--Acres infested by mountain pine beetle, Flathead Indian Reservation, 1987 and 1988.

	Acres infested	
Host	1987	1988
LPP	2,239	1,429
PP	1,917	47
WBP	2	5
WWP	0	2
Total	4,158	1,483

Stillwater, Swan River and Thompson River State Forests (Montana)

A marked reduction of infested acres, most of which are lodgepole pine, was noted on the Stillwater State Forest (SF) in 1988. Most of those lands are on the west side of the Whitefish Mountain Range, along the Stillwater River. As such, those infestations are similar in intensity to ones on the Tally Lake and Glacier View RD's of the Flathead NF. As those infestations declined, so did those on the Stillwater SF. Fewer than one-half the acres shown infested in 1987 (more than 58,000) were reported in 1988 (28,300) (Table 2).

An increase in acres of lodgepole pine infested and a corresponding decrease in acreage of western white pine was noted on the Swan River SF in 1988. Most beetle-caused mortality remained scattered in small groups along tributaries of the Swan River north of Seeley Lake.

Slight increases in infested acres of both lodgepole and ponderosa pines were recorded on State lands within the Thompson River drainage. In total, just over 5,900 acres of lodgepole pine and 390 acres of ponderosa pine were affected. Similar figures for 1987 had been 4,570 acres of lodgepole pine and 207 acres of ponderosa pine (Table 2). Generally, beetle-caused mortality in the vicinity of the Thompson River north of Plains--Thompson River SF and Plains RD, Lolo NF--remained nearly static from 1987 to 1988. Though some stands are showing still building beetle populations, increasing host depletion should result in gradually declining losses.

Craig Mountains (Idaho)

Lodgepole and ponderosa pine stands in the Craig Mountains near Soldiers Meadow Reservoir affected by MPB were less severely impacted in 1988. Though an increase in infested acres was recorded, aerial survey estimates of trees killed declined from more than 18,000 in 1987 to only 8,400 in 1988 (Table 2). Effects of the beetle have been recorded there for nearly a decade. So severe have been the affects on host stands, we expect those outbreaks to continue to decline in 1989.

Cataldo, Clearwater/Potlatch, Kendrick, Mica and West St. Joe Fire Fire Protection Districts (Idaho)

Though small and generally scattered groups of lodgepole and ponderosa pine faders were recorded in several reporting areas in northern Idaho, no major beetle infestations are believed to be building in those stands. On the Cataldo FPD, nearly 250 acres of lodgepole pine near Frost and Wardner Peaks showed beetle-caused mortality. Likewise, 300 acres of lodgepole pine showing varying amounts of faded trees were observed west of Athol and in Farragut State Park within the Mica FPD (Table 2).

DOUGLAS-FIR BEETLE

Douglas-fir beetle (DFB) infestations, which had increased in affected areas fivefold from 1986 to 1987, continued to expand in 1988. We had anticipated a general lessening of outbreak intensity, barring a continuation of extremely dry weather (Gibson and Oakes 1988). Unfortunately, 1988 proved to be the third abnormally dry year in succession. As a result, Douglas-fir stands infested by DFB increased--through at a much reduced rate of expansion. In 1987, 15,500 acres in northern Idaho and western Montana contained DFB-killed trees. Total infested area extended to slightly more than 27,000 acres in 1988 (Table 16).

Though acres on which beetle-killed trees were observed doubled in the past year, most of the affected area remained confined to Douglas-fir stands in northern Idaho and extreme western Montana which have a history of root disease. Trees in those stands have been further weakened by prolonged drought, becoming conducive to population buildups of DFB. Ground surveys conducted in selected stands throughout the infested area show still increasing populations in a few locations. Many others indicate static to decreasing trends (Table 17).

The largest infested areas occurred on the Fernan RD, Coeur d'Alene NF (2,727 acres); Avery RD, St. Joe NF (2,141 acres); Wallace RD, Coeur d'Alene NF (1,224 acres); Priest Lake RD, Kaniksu NF (1,105 acres); North Fork RD, Clearwater NF (2,488 acres); State and private lands within Priest Lake FPD (5,988 acres); and various ownerships within Clearwater/Potlatch FPD (2,215 acres) (Table 16, Appendix, Figures 12, 13, 14, 15 and 16). Many of the areas currently infested are accessible. Where possible, salvage and hazard-reduction efforts are underway. Management activities and much-improved precipitation during the winter 1988-1989 should result in significant decreases in infestation extent and intensity in 1989.

PINE ENGRAVER

Though unusually dry weather prevailed for a third year in much of northern Idaho and Montana, the effects of pine engraver beetles decreased in 1988. Engraver beetles (Ips), opportunists as are most bark beetles, are typically more severe during abnormally hot and dry years. That fewer acres on which trees killed by pine engravers were noted during the past year is likely reflective of an awareness of the beetles' impacts and efforts to lessen them. Still, ponderosa pine stands in several areas in northern Idaho are suffering tree killing in epidemic proportions. Most severe are stands on the Nez Perce IR where 2,090 trees were killed on 641 acres, private lands within the Pend Oreille SF reporting area -- 565 dead trees on 346 acres, private land throughout the Mica SF reporting area -- 1,990 acres infested with 5,270 trees killed, and privately owned land within the Craig Mountains where a total of 1,780 trees were killed on 447 acres. Throughout northern Idaho, on lands of all ownerships, an estimated 13,900 trees were killed and slightly more than 4,500 infested acres. With the exception of those areas noted, most beetle-caused mortality occurred in small scattered 5- to 50-tree groups (Appendix, Figure 17).

In Montana, very little pine engraver damage was noted (Appendix, Figure 17). Approximately 200 trees were killed, statewide, on 75 acres. Most of that infested area, 69 acres, was recorded on the Flathead IR. However, only 20 trees were estimated to have been killed there. The remainder was in small and widely scattered groups. Late-season fires in ponderosa and lodgepole pine stands in eastern Montana and Yellowstone NP could produce conditions conducive to population expansions of engraver beetles. That potential will need to be monitored closely in 1989.

Table 16.--Acres infested and mortality attributed to Douglas-fir in the Northern Region by reporting area, 1987 and 1988.

	-----1987-----			-----1988-----		
Reporting area	Acres	Trees	Vol. (MBF)	Acres	Trees	Vol. (MBF)
Beaverhead NF	--	--	--	621	440	88.0
Bitterroot NF	14	126	25.2	881	1,866	373.2
Idaho Panhandle NF's	7,694	13,843	4,845.0	8,888	23,023	8,058.0
Clearwater NF	3,787	10,286	3,600.1	4,780	11,899	4,164.6
Custer NF	1	3	0.6	0	0	0
Deerlodge NF	1	2	0.4	1	5	1.0
Flathead NF	3	29	5.8	110	112	22.4
Gallatin NF	1	3	0.4	1	5	1.0
Helena NF	4	10	2.0	18	20	4.0
Kootenai NF	2	6	1.2	1,020	1,468	293.6
Lewis & Clark NF	1	5	0.6	1	5	1.0
Lolo NF	108	220	44.0	664	1,485	297.0
Nezperce NF	91	414	144.9	359	1,789	626.1
Swan River SF	--	--	--	40	174	34.8
Nez Perce IR	1	5	0.4	0	0	0
Flathead IR	126	143	28.6	10	91	18.2
Rocky Boy's IR	1	3	0.4	*	*	*
Thompson River SF	--	--	--	1	5	1.0
Priest Lake FPD	134	1,325	463.8	5,998	8,725	3,053.7
Pend Oreille FPD	60	560	196.0	575	1,536	537.6
Mica FPD	2,352	14,105	4,936.7	157	1,264	442.4
Cataldo FPD	100	145	50.8	479	1,862	207.2
W. St. Joe FPD	282	965	337.7	292	719	251.7
Kendrick FPD	3	25	8.8	16	160	56.0
Clw/Potlatch FPD	673	3,249	1,137.1	2,215	5,162	1,806.7
Maggie Cr. FPD	29	234	81.9	25	184	64.4
Craig Mtns.	35	132	46.2	10	115	40.3
Garnets (BLM)	14	34	6.8	20	56	11.2
Total	15,517	45,871	15,967.3	27,182	62,134	20,455.1

* Not flown in 1988.

Table 17.--Douglas-fir killed by Douglas-fir beetle, selected plots (83) throughout infested area in northern Idaho and western Montana, 1988.

Location	Older	1987	1988	To date	Trend
Beaverhead NF	9.3	8.3	29.3	46.9	Increasing
Clearwater NF	15.6	16.9	3.5	36.0	Static
IPNF's (CDA)	4.4	15.4	8.8	28.6	Static
IPNF's (Kaniksu)	4.7	18.9	11.8	35.4	Increasing
IPNF's (St. Joe)	12.2	26.8	9.3	48.3	Static
Kootenai NF	21.9	13.4	21.0	56.3	Static

WESTERN PINE BEETLE

Ponderosa pine stands exhibiting infestations of western pine beetle (WPB) in 1988 expanded to more than 2,300 acres in northern Idaho. An estimated 2,600 trees have been killed. In 1987, aerial survey estimates showed 460 acres infested and almost 900 trees killed. Major infestations were observed on lands within Pend Oreille SF, where 273 acres were affected; private land within Mica SF reporting area -- slightly fewer than 800 acres; stands within the Clearwater/Potlatch FPD -- 365 acres; and ponderosa pines on 332 acres in the Craig Mountains.

Several stands surveyed in western Montana showed significant amounts of WPB-caused mortality in second-growth ponderosa pine. Often, WPB is found in association with other bark beetles--notably MPB, pine engravers and red turpentine beetle (RTB). For that reason, no accurate estimates of the extent of the infestation in Montana are available. Personal observations suggest it is considerable. An 80-acre stand on the Superior RD, Lolo NF, in which data were collected showed an average of 46 trees per acre killed over the past 3 years.

Western pine beetle population dynamics research suggests outbreaks are closely associated with drought-induced stress in host trees. If, as it appears, precipitation is to be more nearly normal in 1989, we could expect a corresponding decline in losses attributed to WPB.

FIR ENGRAVER

Tremendous increases in grand fir mortality attributed to fir engraver (Scolytus) were observed in 1988. Extending to only 2,200 acres in northern Idaho in 1987, infested acres now number more than 33,600. While an average of only slightly more than one tree per acre has been killed, that total for the past year exceeded 44,300. A part of the root disease/bark beetle normally found at high endemic levels in grand fir stands throughout northern Idaho, the fir engraver has taken advantage of additional stress placed on host trees by hot, dry weather. When those conditions ameliorate, fir engraver populations will return to less damaging, but still wide-ranging proportions. Areas with particularly high amounts of beetle-killed

grand fir are found on the Palouse RD, Clearwater NF; Clearwater RD, Nezperce NF; and private lands on the Pend Oreille SF, Mica SF, Kendrick SF, Clearwater/Potlatch FPD, and Maggie Creek FPD (Appendix, Figure 18).

No areas showing major amounts of fir engraver-killed trees were recorded in Montana. Forty-six acres were observed on the Superior RD, Lolo NF; and 13 acres on the Flathead IR (Appendix, Figure 18). In each area, approximately one tree per acre was estimated killed.

WESTERN BALSAM BARK BEETLE

Mortality in subalpine fir stands, for which the western balsam bark beetle (WBBB) was thought to be a major contributor, declined Regionwide in 1988. In northern Idaho, a total of 179 recently killed subalpine fir were observed in small, widely scattered groups. Affected area totaled 53 acres. Almost always associated with root disease-weakened trees, WBBB is but one of a complex of pests of subalpine fir. Now, we have observed an expanded range of the balsam woolly adelgid in northern Idaho. Some subalpine fir mortality noted during annual aerial surveys could be attributable to this pest.

SPRUCE BEETLE

While not all areas containing old-growth spruce stands were flown in 1988, the amount of Engelmann spruce recorded killed by spruce beetle (ESB) suggests populations are at endemic levels Regionwide. Fifty-seven faded trees were noted in several locations on the Flathead NF, and another three dead trees were observed on the Three Rivers RD, Kootenai NF. Total affected area was only 15 acres. The last major ESB epidemic in the Northern Region was successfully treated through silvicultural means from 1982 to 1984.

ACKNOWLEDGEMENTS

The compilation of these bark beetle "conditions" would not have been possible without the combined efforts of many. The assistance of the Entomology Group, Timber, Cooperative Forestry and Pest Management, both permanent and seasonal personnel, was invaluable. Rather than list them individually, we thank them all collectively.

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Gibson, K. E., and R. D. Oakes. 1988. Bark beetle conditions, Northern Region, 1987. USDA For. Serv., North. Reg. FPM Rept 88-4. 39 pp.

Appendix

SCIENTIFIC NAMES

Beetles

Mountain pine beetle	*Dendroctonus ponderosae* Hopkins
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopkins
Pine engraver	*Ips pini* Say
Fir engraver	*Scolytus ventralis* LeConte
Western pine beetle	*Dendroctonus brevicomis* LeConte
Spruce beetle	*Dendroctonus rufipennis (Kirby)*
Western balsam bark beetle	*Dryocoetes confusus* Swaine

Hosts

Lodgepole pine	*Pinus contorta* var. *latifolia* Engelmann
Ponderosa pine	*Pinus ponderosa* Laws
Western white pine	*Pinus monticola* Douglas
Whitebark pine	*Pinus albicaulis* Engelmann
Limber pine	*Pinus felxilis* James
Douglas-fir	*Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco
Grand fir	*Abies grandis* (Douglas) Lindl.
Subalpine fir	*Abies lasiocarpa* (Hook.) Nutt.
Engelmann spruce	*Picea engelmannii* Parry

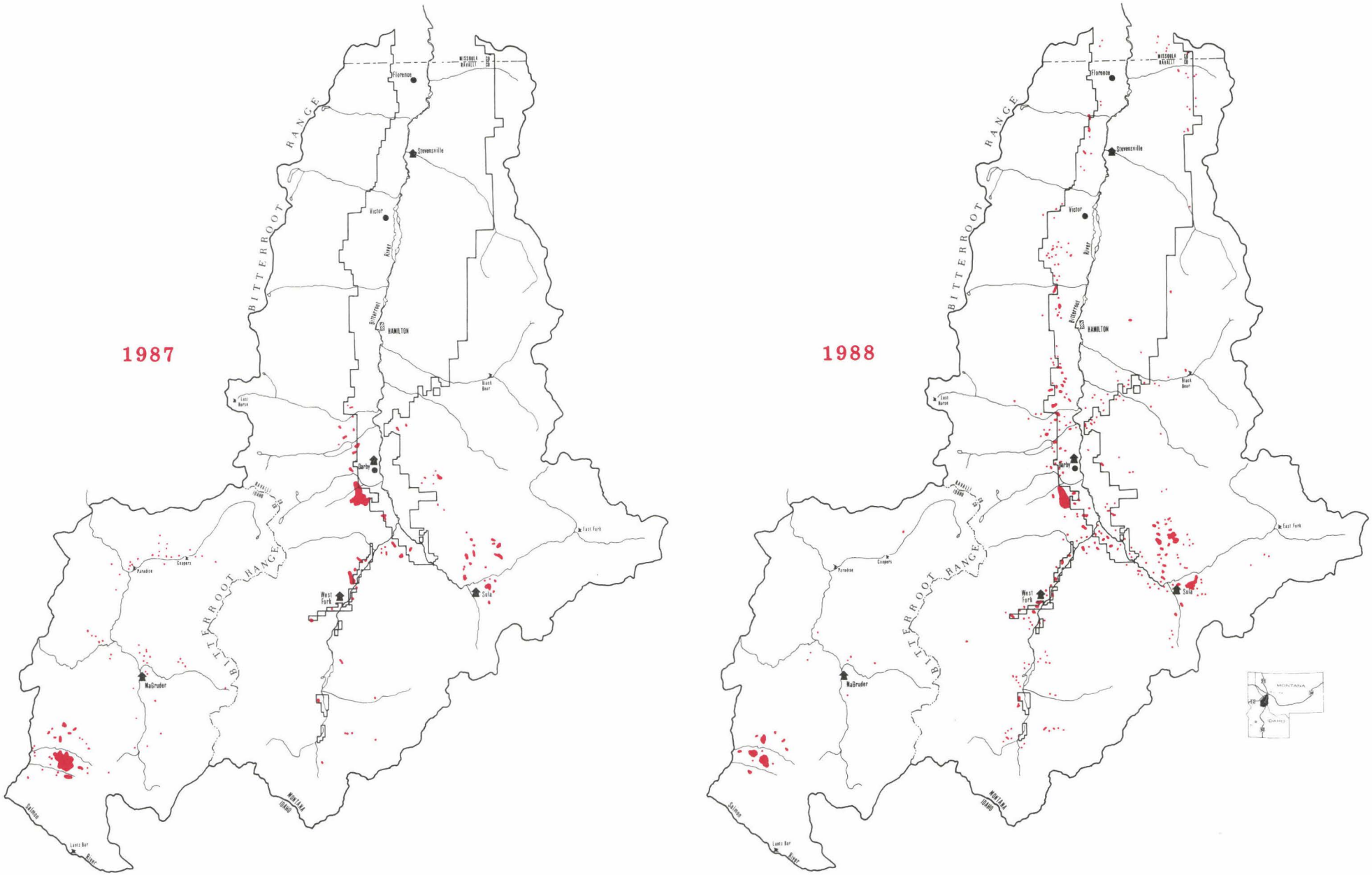


Figure 1.--Areas of pines infested by mountain pine beetle, Bitterroot National Forest area, Idaho and Montana.

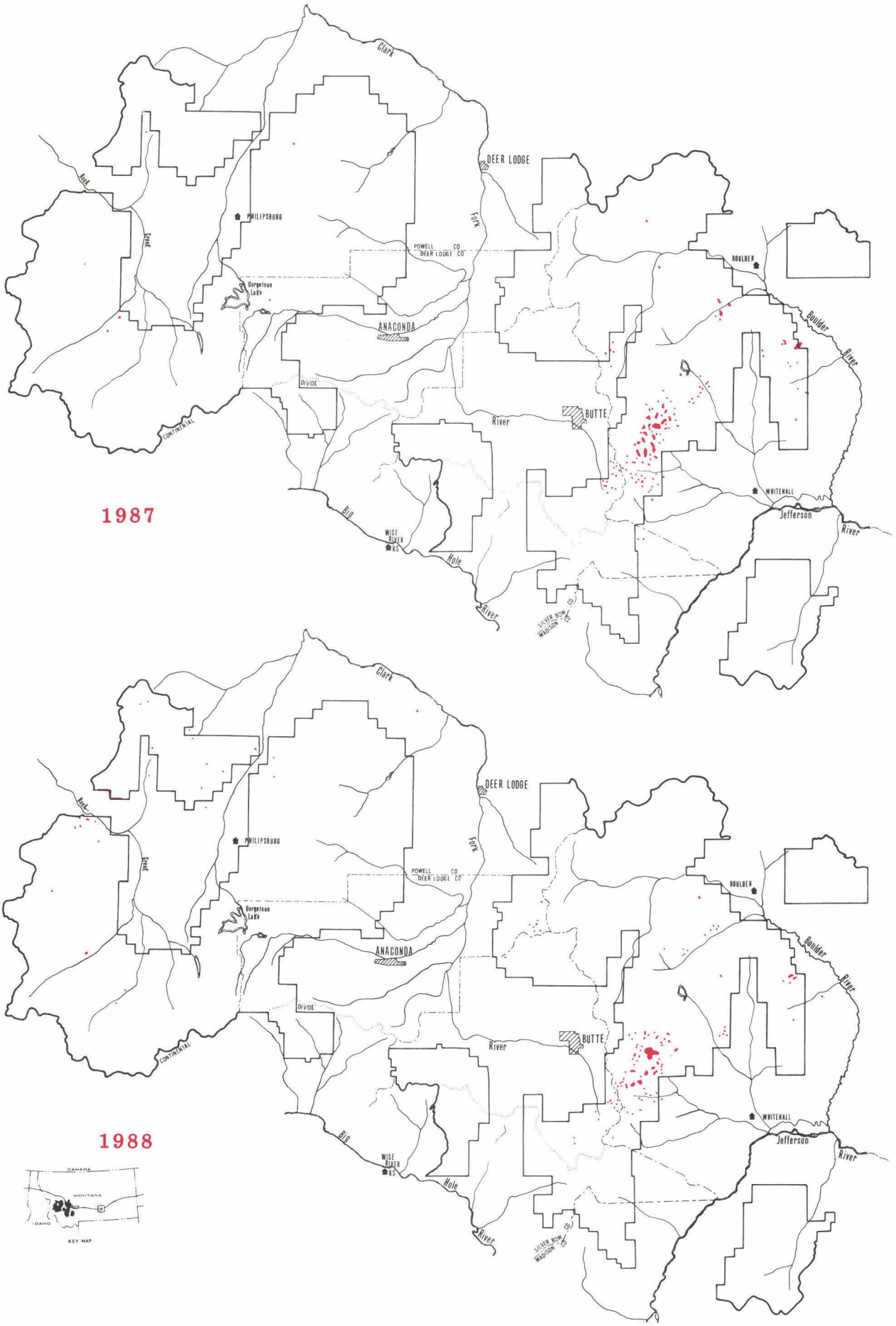


Figure 2.--Areas of pines infested by mountain pine beetle, Deerlodge National Forest area, Montana.

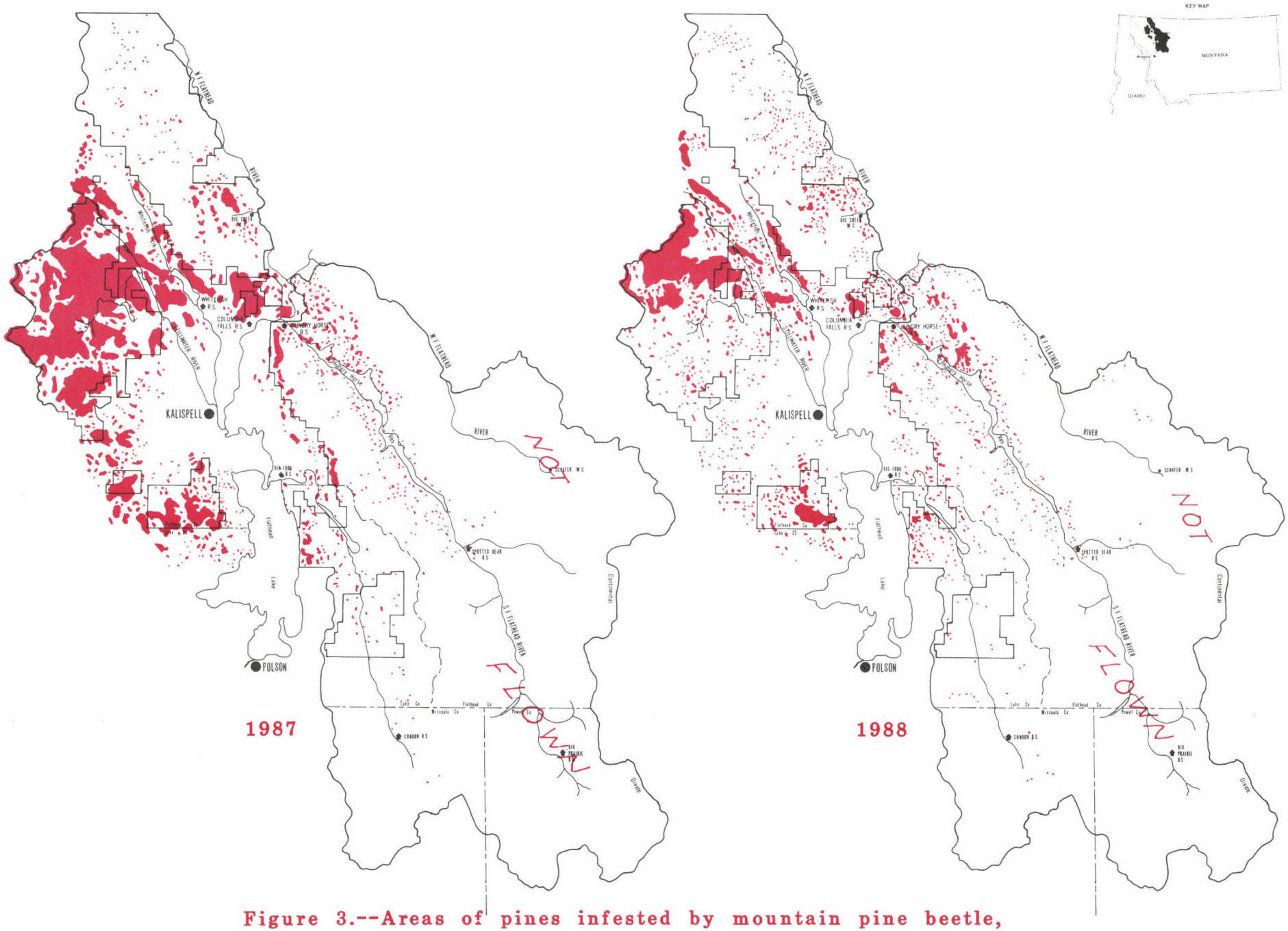


Figure 3.--Areas of pines infested by mountain pine beetle, Flathead National Forest area, Montana.

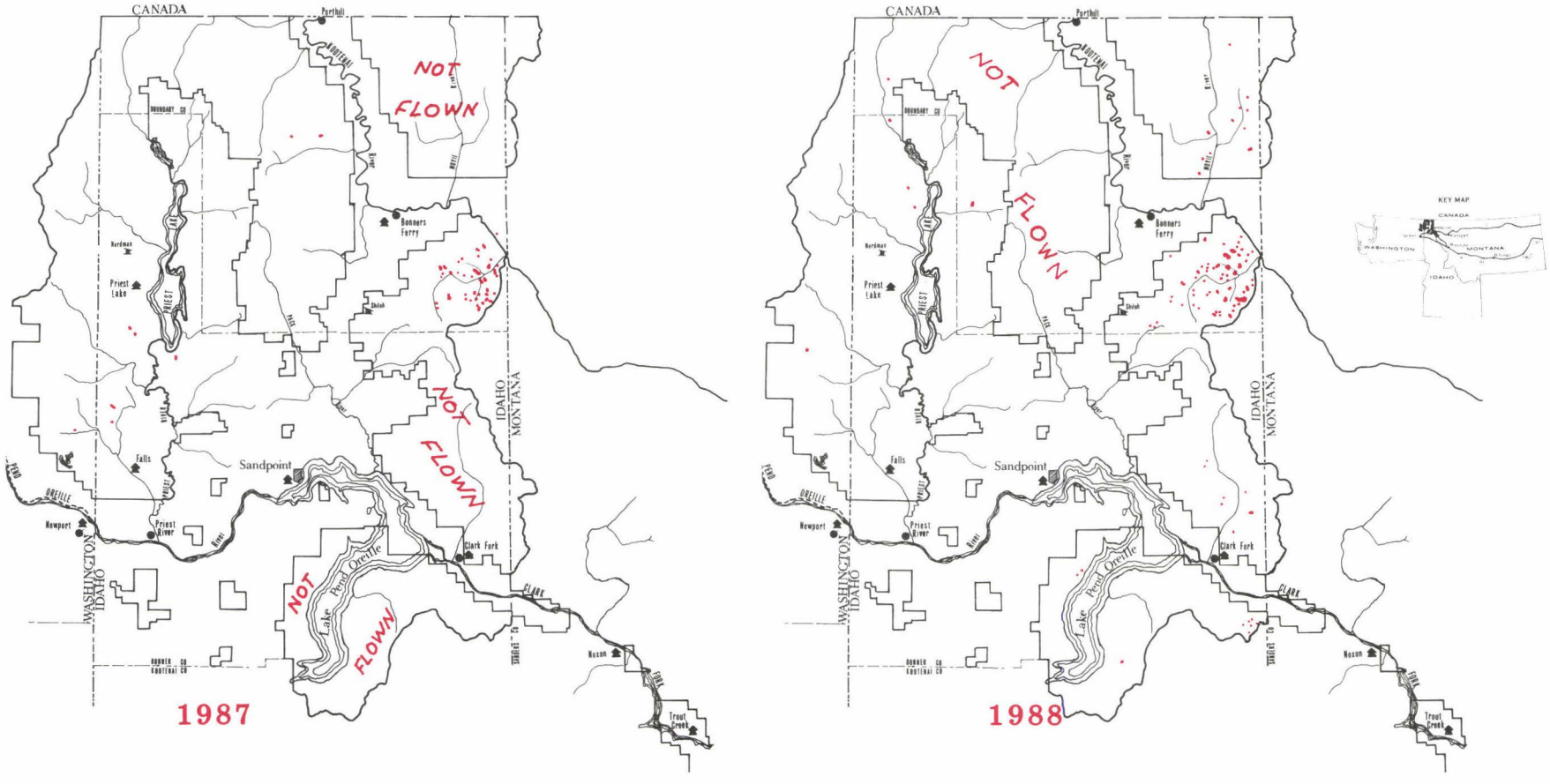


Figure 4.--Areas of pines infested by mountain pine beetle, Idaho Panhandle National Forests (Kaniksu NF) area, Idaho.

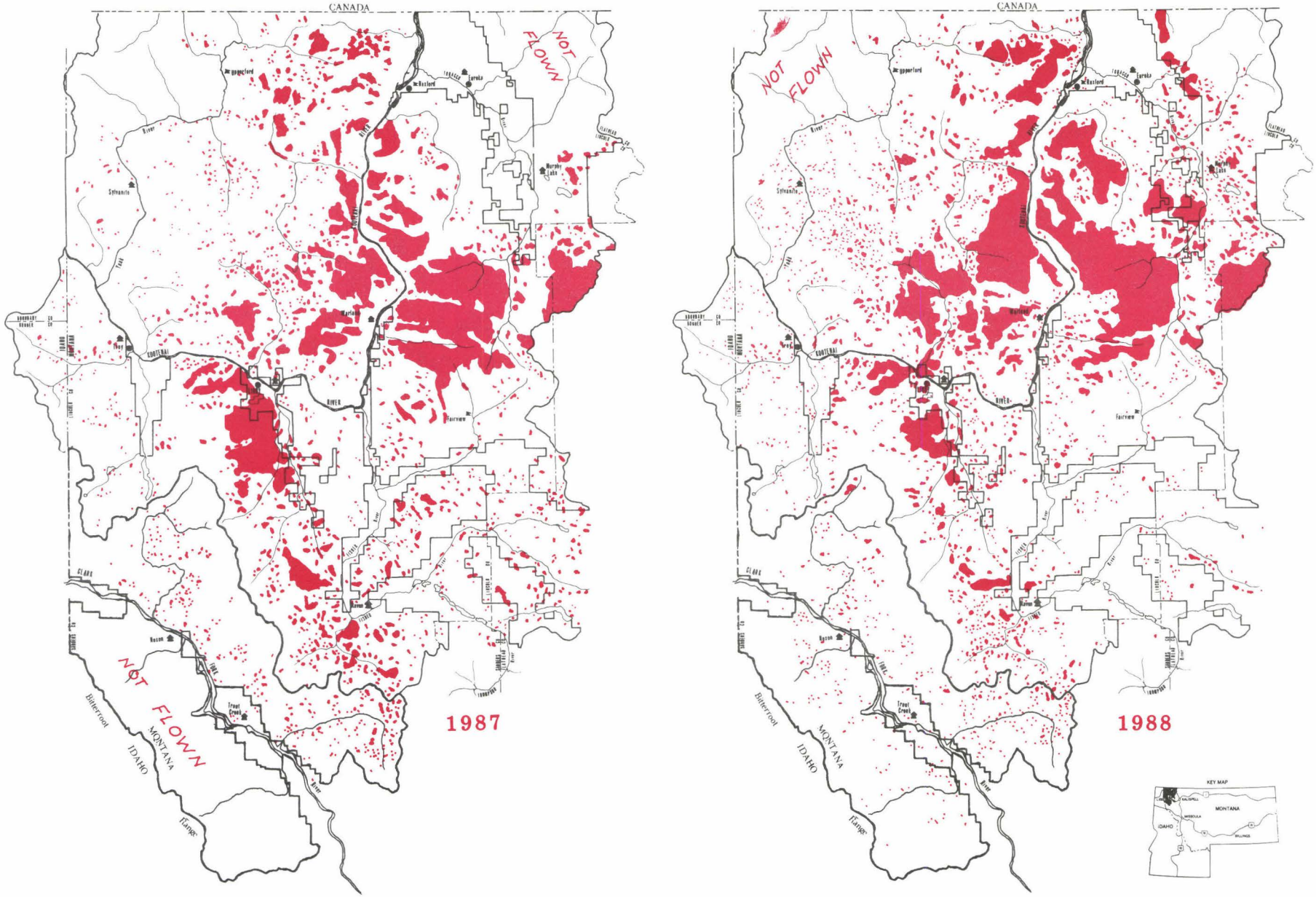


Figure 5.--Areas of pines infested by mountain pine beetle, Kootenai National Forest area, Montana.

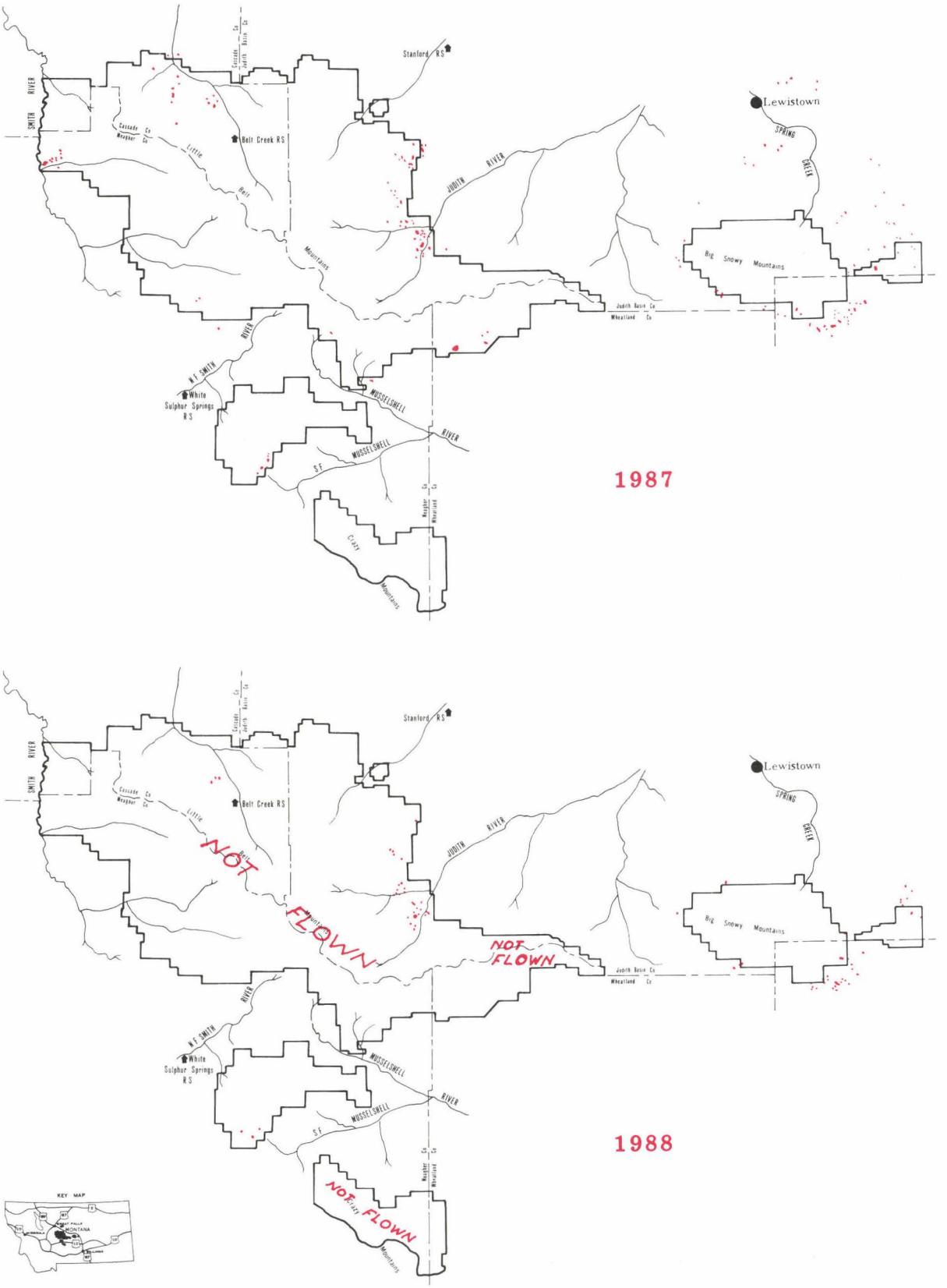


Figure 6.--Areas of pines infested by mountain pine beetle, Lewis & Clark National Forest area, Montana.

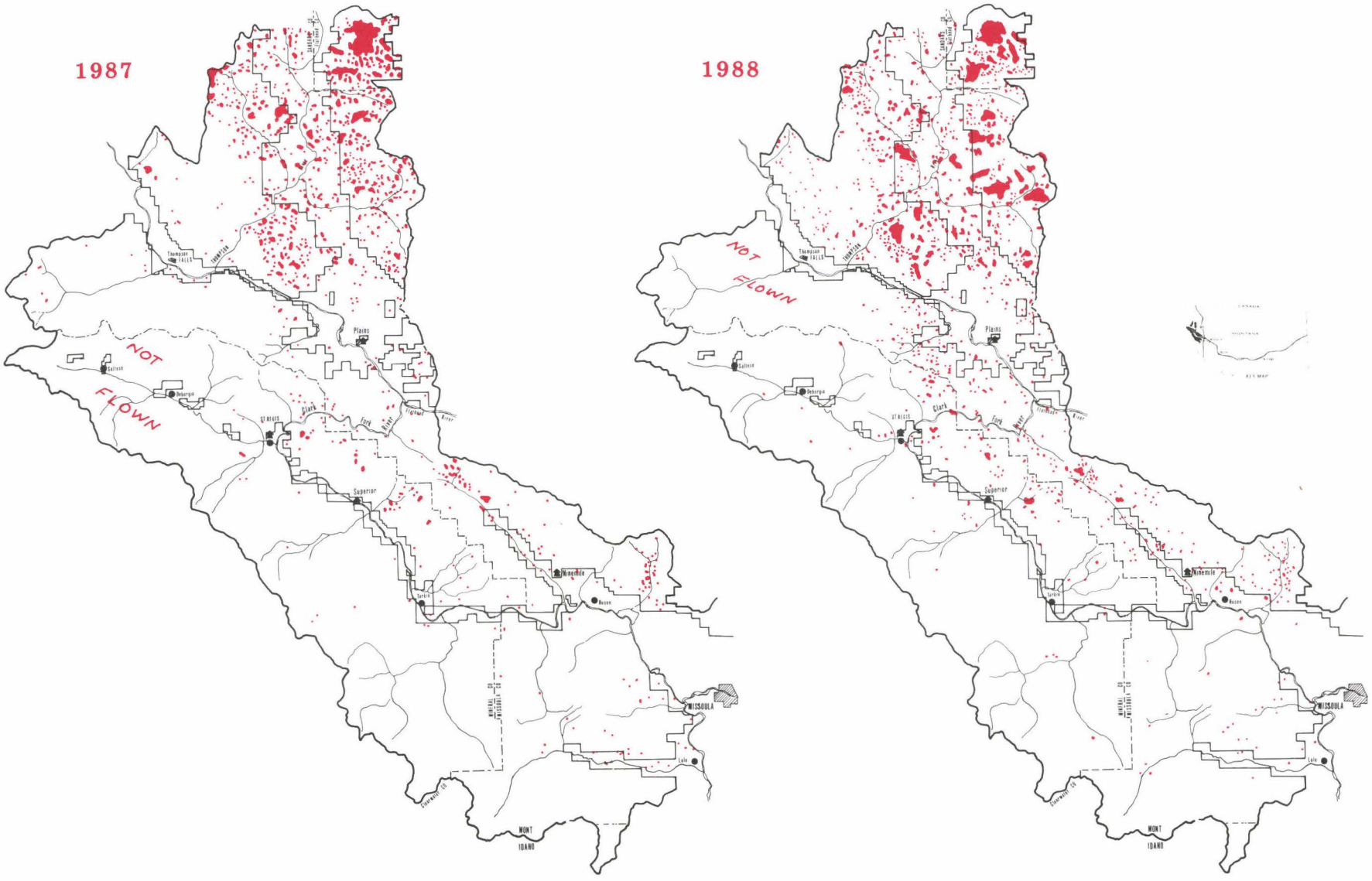


Figure 7.--Areas of pines infested by mountain pine beetle, Lolo National Forest area(west half), Montana.

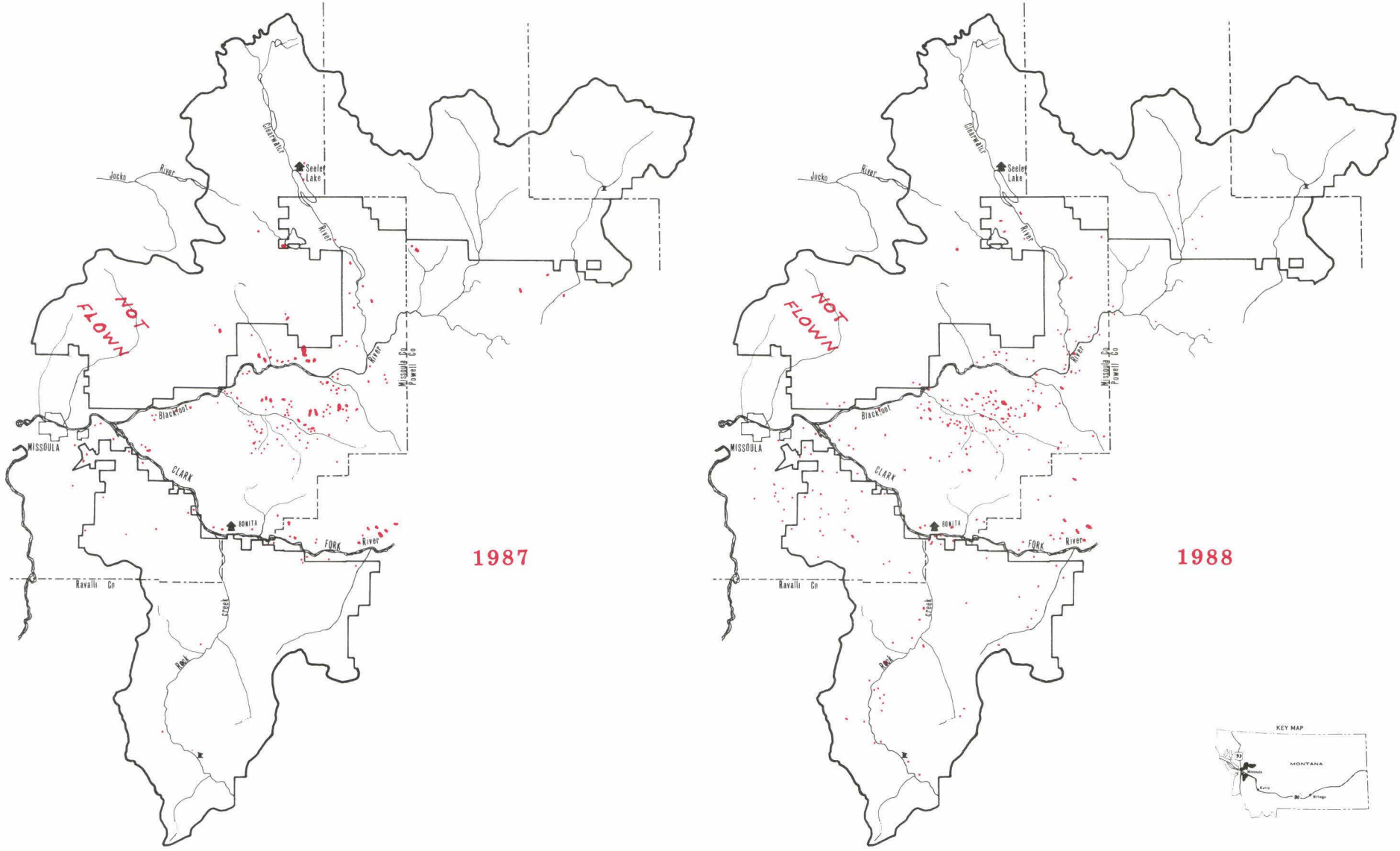


Figure 8.--Areas of pines infested by mountain pine beetle, Lolo National Forest area(east half), Montana.

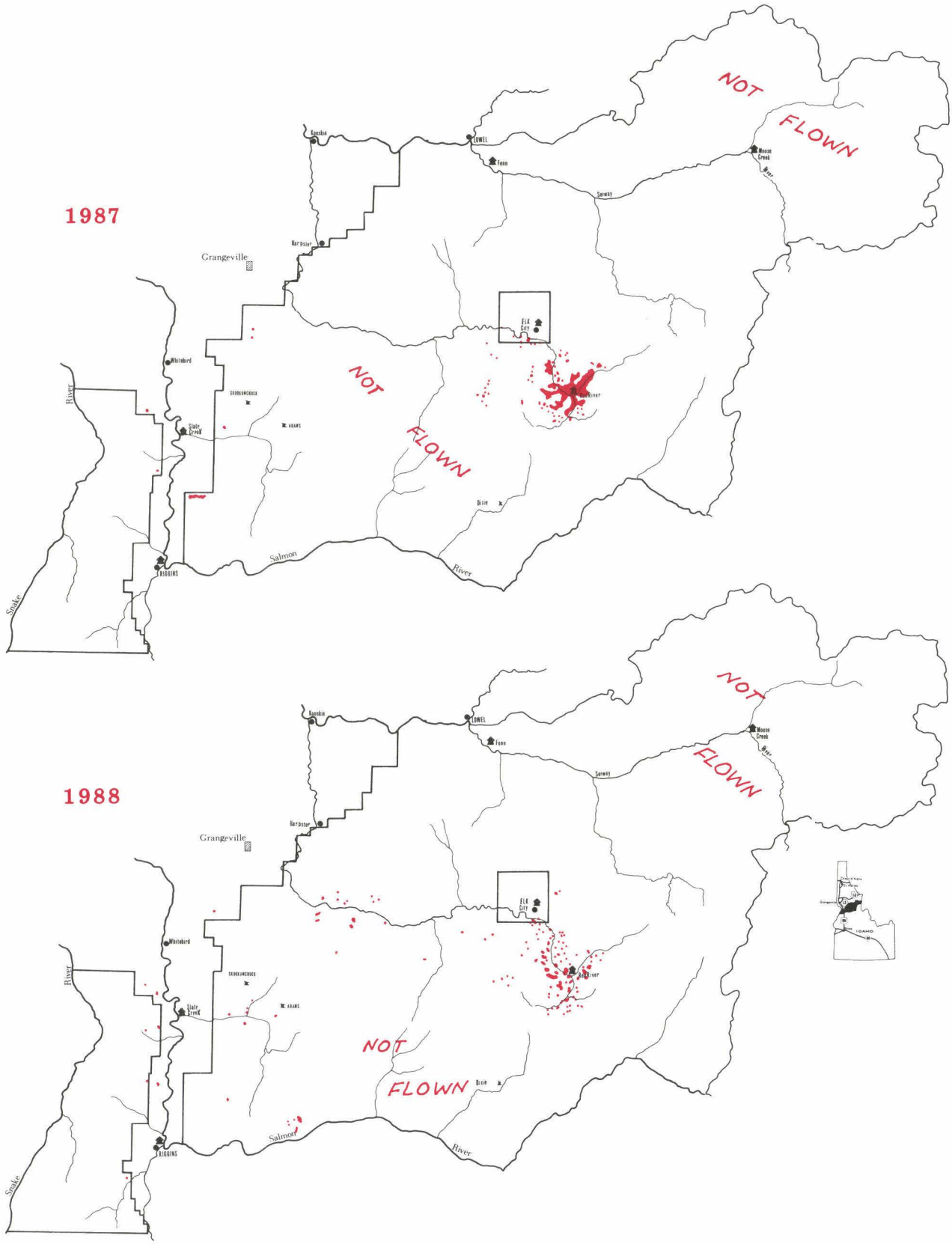


Figure 9.--Areas of pines infested by mountain pine beetle, Nezperce National Forest area, Idaho.

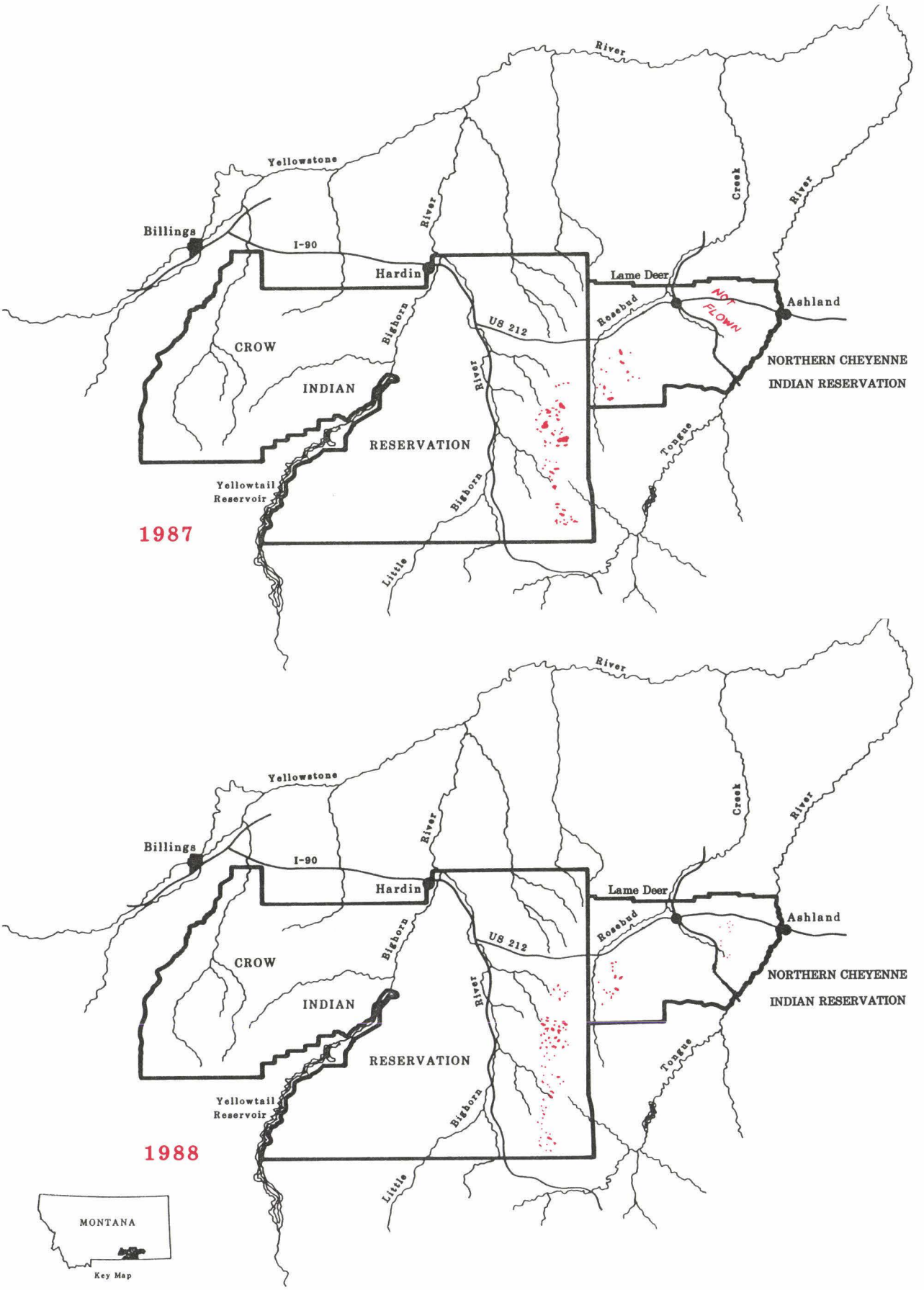


Figure 10.--Areas of pines infested by mountain pine beetle, Crow & Northern Cheyenne Indian Reservations, Montana.

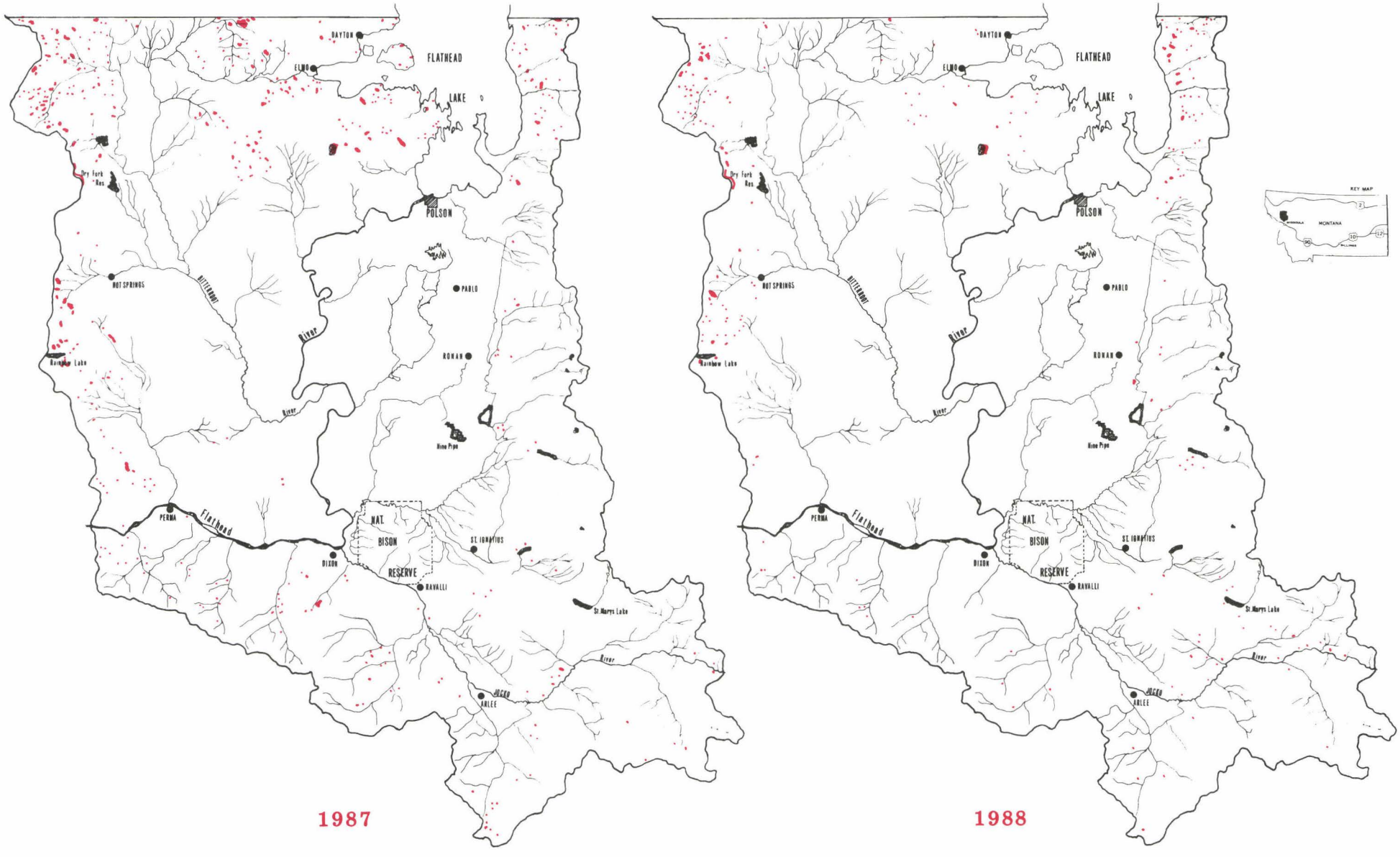


Figure 11.--Areas of pines infested by mountain pine beetle, Flathead Indian Reservation, Montana.

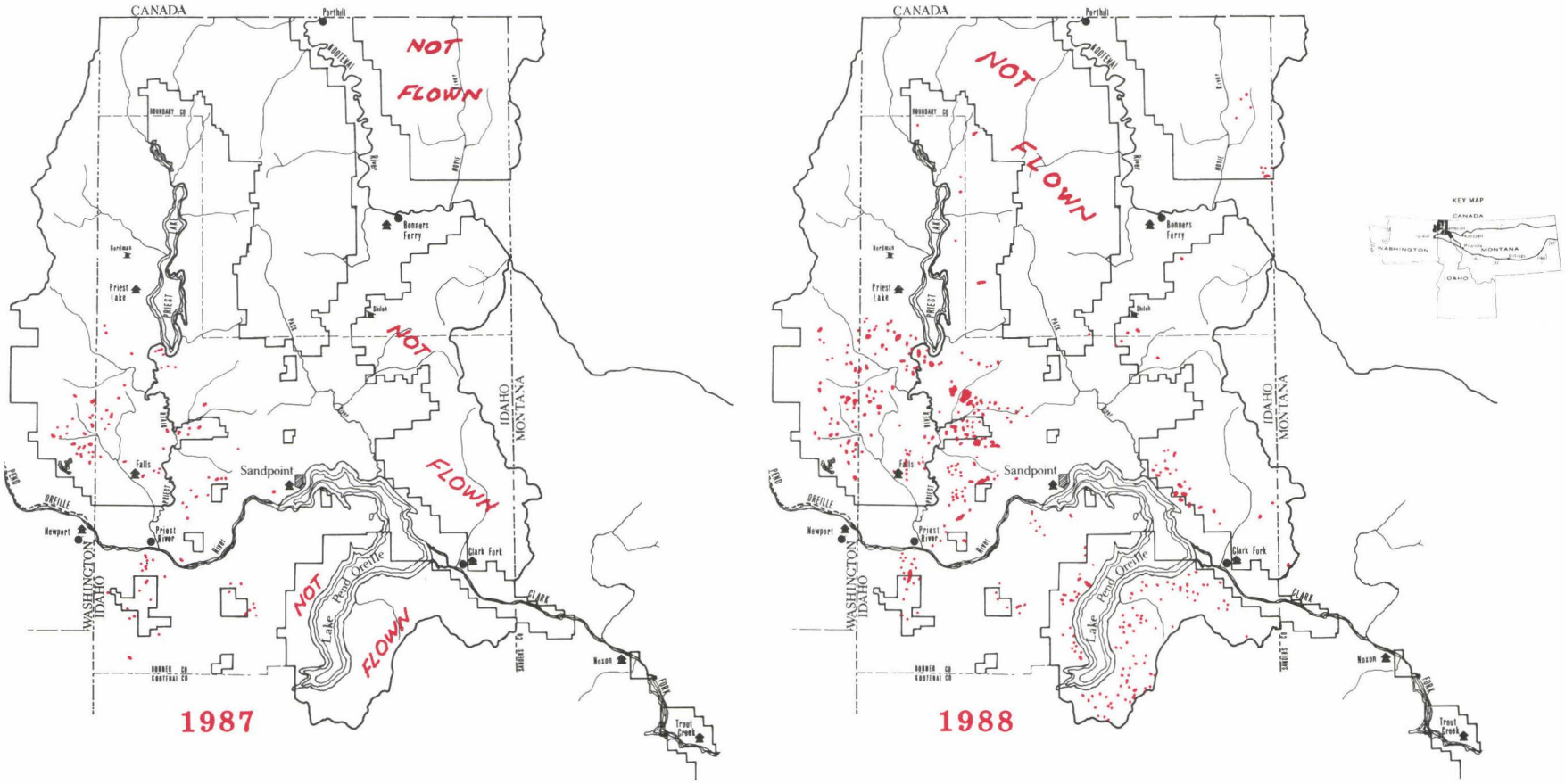


Figure 12.--Areas of Douglas-fir infested by Douglas-fir beetle, Idaho Panhandle National Forests (Kaniksu NF) area, Idaho.

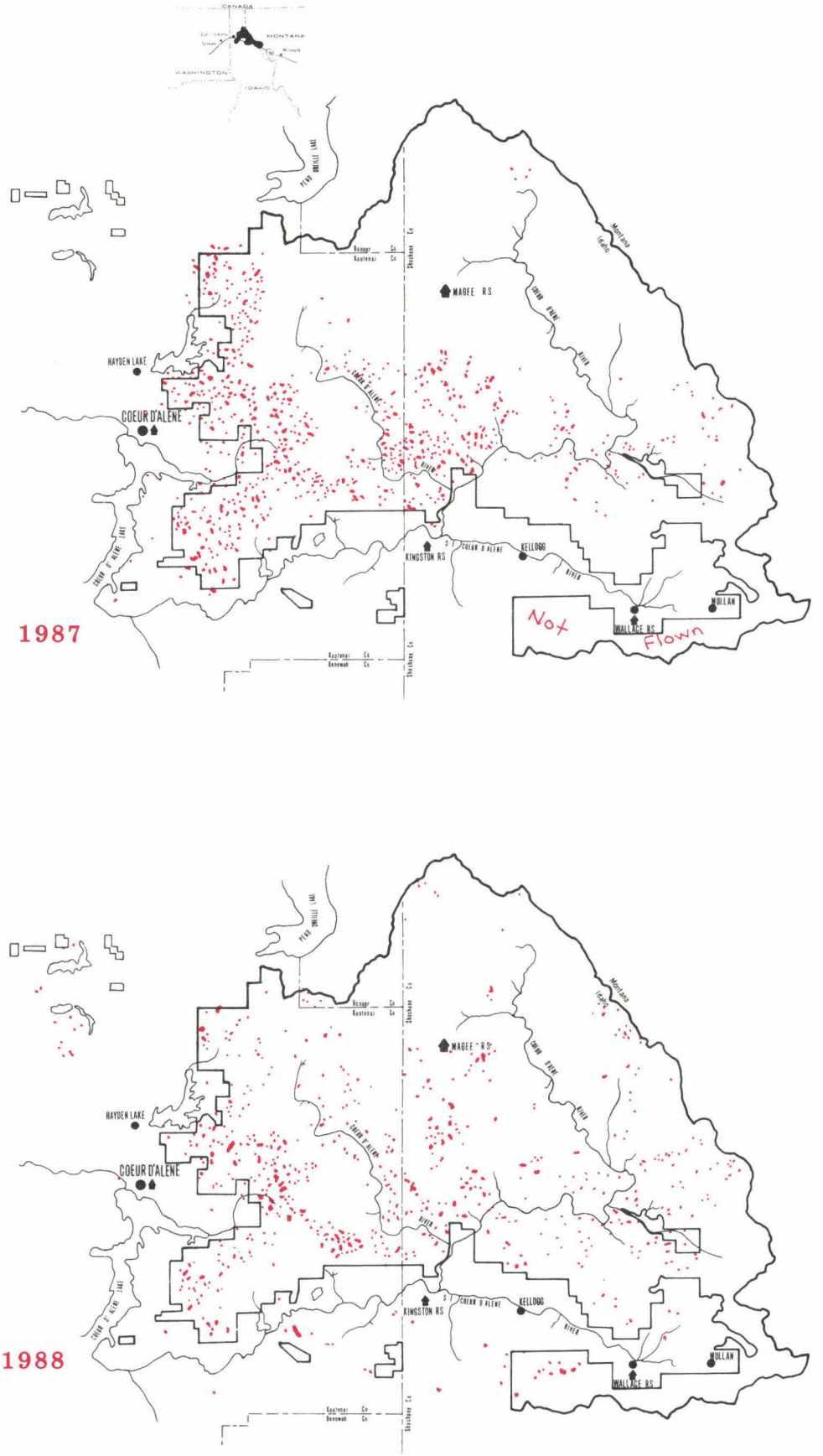


Figure 13.--Areas of Douglas-fir infested by Douglas-fir beetle, Idaho Panhandle National Forests (Coeur d' Alene NF) area, Idaho.

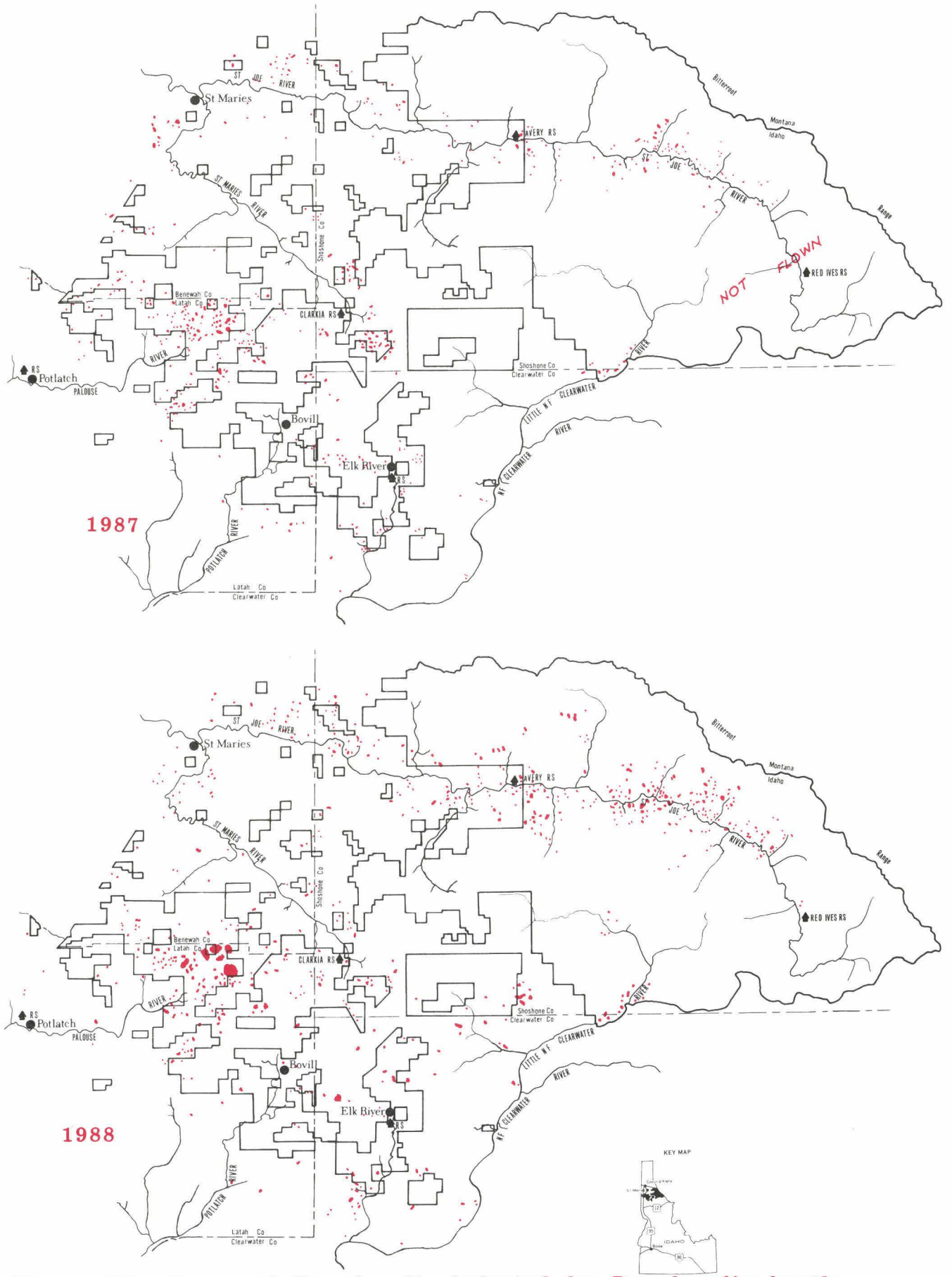
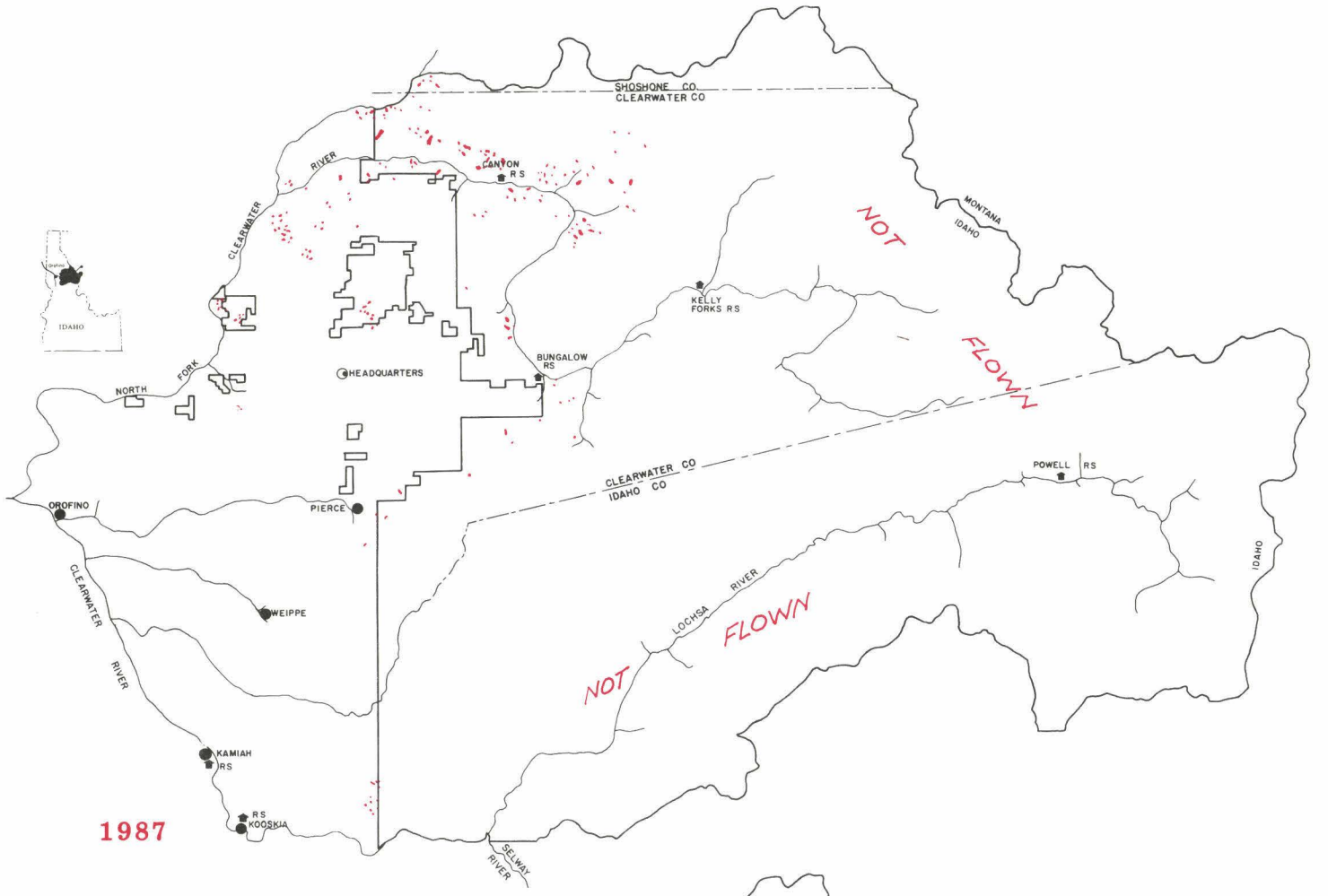


Figure 14.--Areas of Douglas-fir infested by Douglas-fir beetle, Idaho Panhandle National Forests (St. Joe NF) area, Idaho.



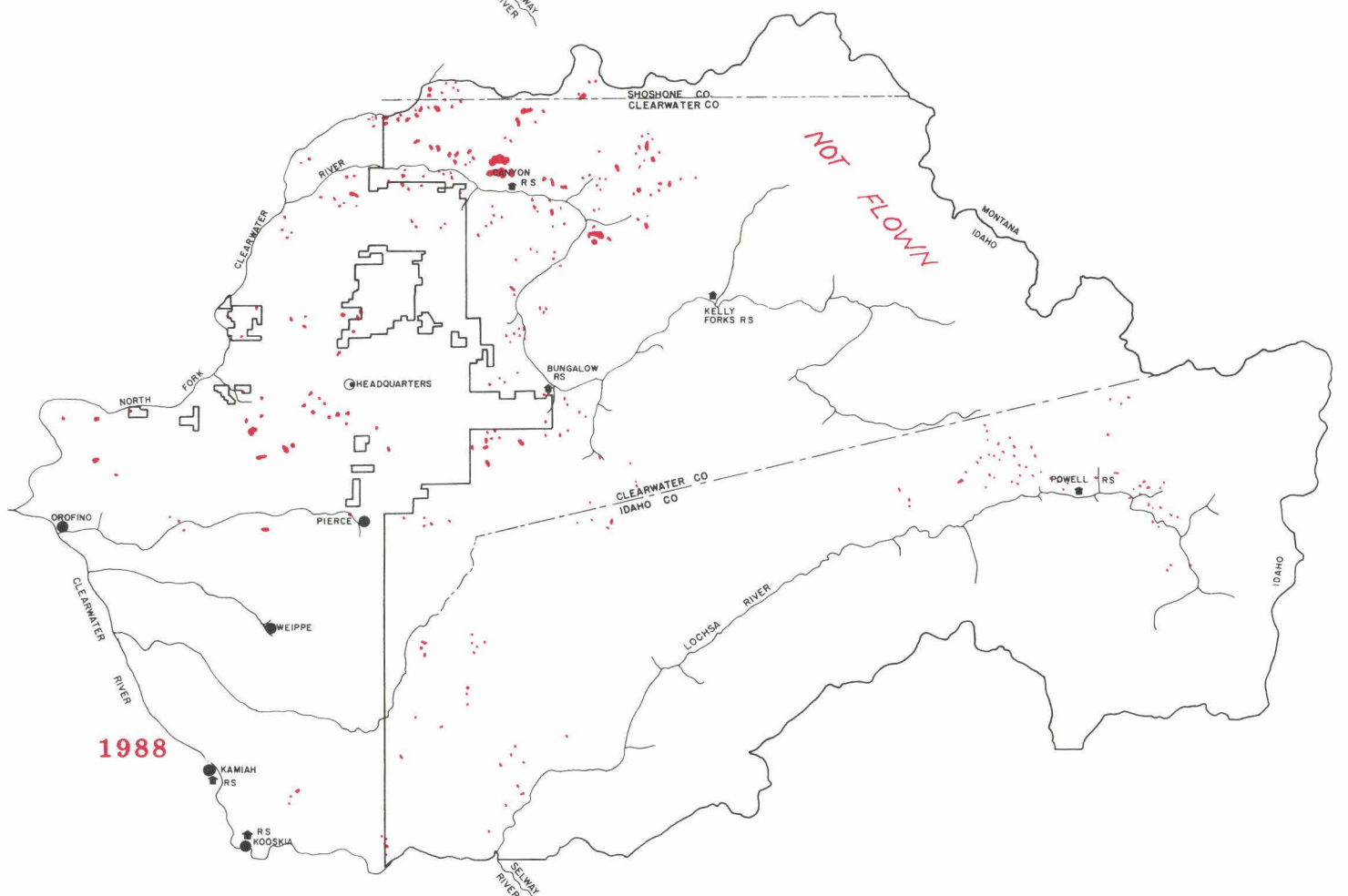


Figure 15.--Areas of Douglas-fir infested by Douglas-fir beetle, Clearwater National Forest area, Idaho.

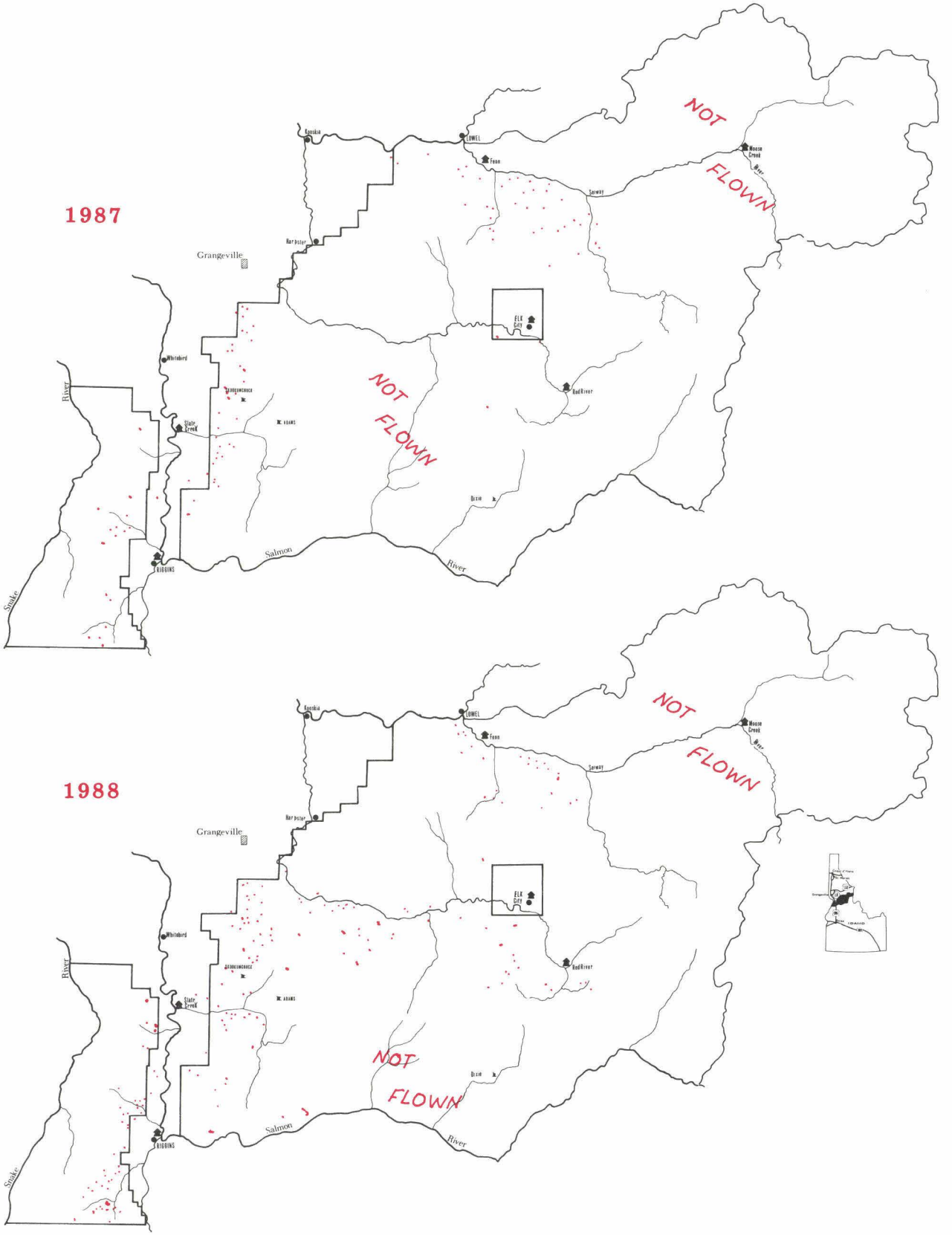


Figure 16.--Areas of Douglas-fir infested by Douglas-fir beetle, Nezperce National Forest area, Idaho.

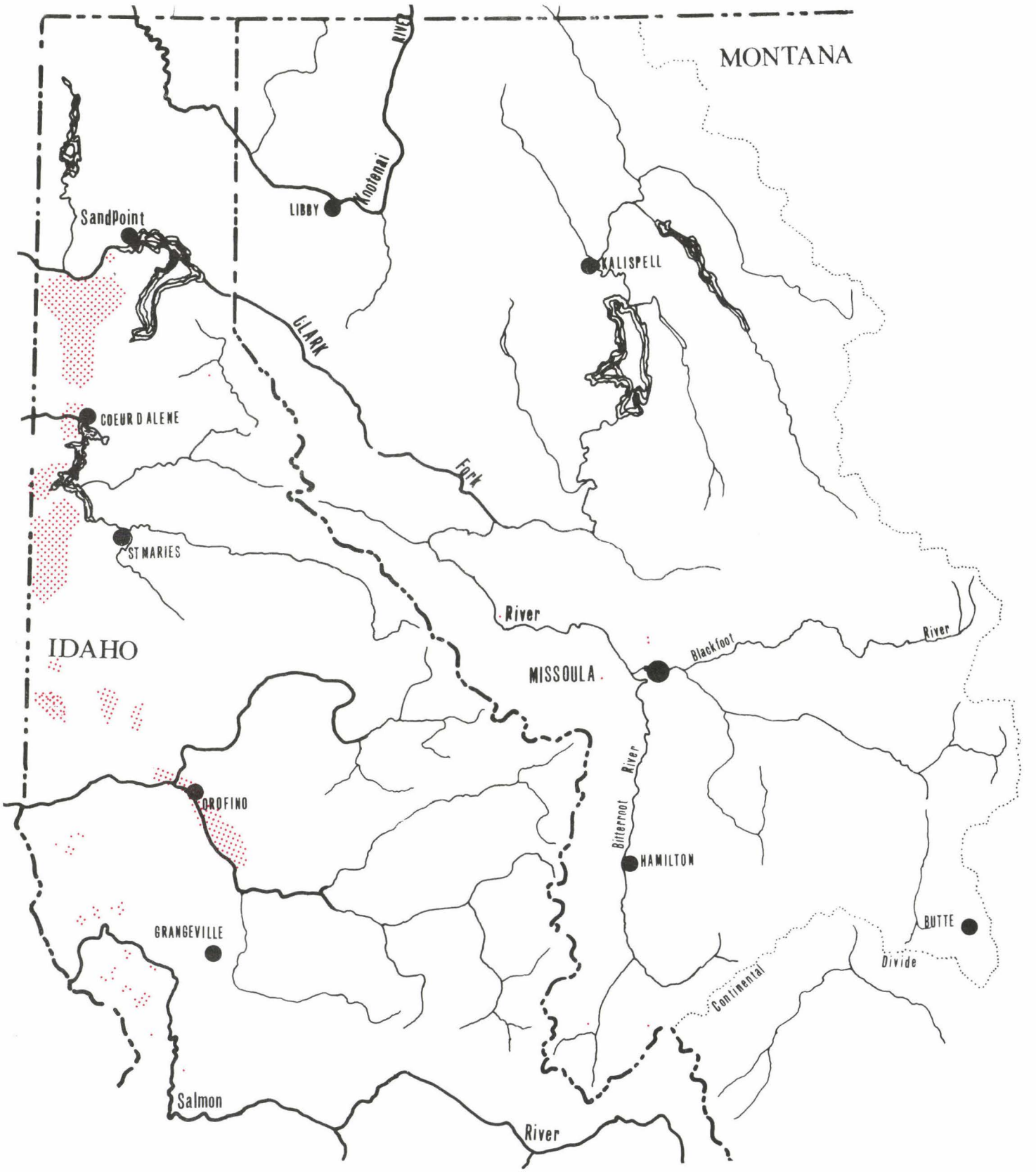


Figure 17.--Areas of pines infested by pine engraver beetle, northern Idaho and western Montana.

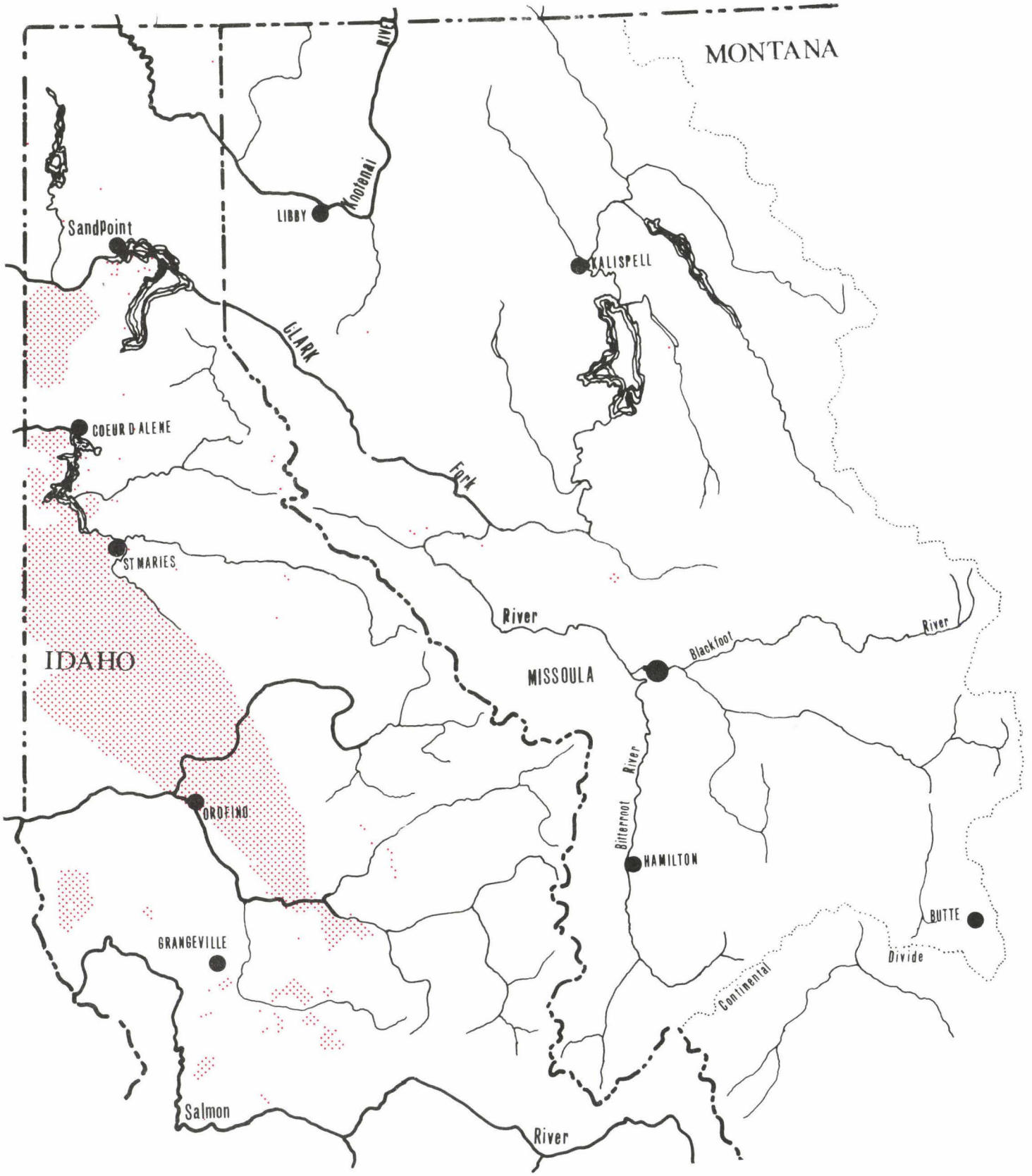


Figure 18.--Areas of grand fir infested by fir engraver beetle, northern Idaho and western Montana.